RAILROAD GAZETTE

FRIDAY, MAY 20, 1898.

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The Black Prince—A Correction.

In the Railroad Gazette of April 15, page 277, was shown a perspective view of the "Black Prince," the 4-cylinder compound locomotive recently built by Mr. Webb for the London & North Western. Mr. Webb calls our attention to a typographical error in the statement of the size of the cylinders. The diameter of the two (outside) high pressure cylinders is 15 in., and that of the two (inside) low pressure, 19½ in.

Contributions.

Russian Markets for Railroad Material.

St. Petersburg, April 26.

To the Editor of the Railroad Gazette:

In reply to yours I would say that I have made inquiry of the most likely railroad boards here, respecting a translation into English, French or German, of the Russian Government specifications for rails, from which it appears that no such translation has ever been made. There is, in fact, no occasion for it, as all Russian railroads are compelled by Government to use none but Russian material, both for permanent way and rolling stock. Special permission is sometimes, but very exceptionally, given to import rolling stock, but no such permission has ever been given to import rails (at about one-half Russian price, and better quality) since the policy of excluding foreign produce as much as possible was started under the late emperor's auspices. I could give some very remarkable instances of the ridiculous lengths to which this exclusion is occasionally carried.

The fact that the Trans-Manchurian Railway has ordered almost all of its material abroad is quite isolated, but it must be remembered that the "private company" is simply a diplomatic myth; the line is purely and simply the Government, which, of course, does precisely what it likes.

The chief points of the Russian Government's specification for rails were given in the article on the Trans-Manchurian permanent way, which you published Dec. 10, 1897. There is nothing else therein of special importance.

A.

The Ship Canal from the Lakes to the Sea.

Institution of Civil Engineers, London, May 2, 1898.

To the Editor of Railroad Gazette:

I found here the report by Major Symons on the Ship Canal from the Great Lakes on my arrival from the Continent. I have read it with great interest and profit as well. I consider it the most valuable report on the subject ever brought forward, and am sorry it was confined to the United States territory. The report will be a needed addition to the literature of the general subject of an enlarged waterway between the great lakes and the seaboard. It brings out more fully than the advocates of a ship canal would do or have done the great factor that railroads are in the problem, and they will be still greater as time goes on.

I wrote a little on this subject some years ago in the discussion of Mr. Sweet's ship canal paper before the American Society of Civil Engineers, and yet, should I write on the subject now, I could make a still greater point in favor of the railroads, for the development I then predicted in unit of mass of freight carried is rapidly coming forward, cars being now built of 100,000 pounds capacity, and larger still are coming. My suggestion then of great cargo carriers running on four rails or more (like the ship railroad projects) may in the future, and the near future, seem more reasonable than they did twelve years ago.

I am now inclined to believe that Montreal (on the route I found to be the best, via the St. Lawrence River) would be a transhipping point from inland to ocean waters.

E. L. CORTHELL.

Train Lighting by Storage Battery.

Accumulatoren-Fabrik Aktiengesellschaft, Berlin, April 29, 1898.

To the Editor of the Railroad Gazette:

Although well acquainted with the slow progress of electric train lighting in America, I thought that of late some advance had been made in that respect. It is my belief that in Europe as well as in America, the system of employing storage batteries alone has a chance of being generally adopted, the system of axle lighting, or that of generating the electric current by an engine and dynamo, carried in the baggage car, having proved too unreliable up to date.

Unfortunately the Electric Storage Co. of Philadelphia, which has acquired our patents for the United States, does not seem to have paid much attention to the employment of storage batteries for this object.

The electric system of car-lighting extends itself every day more, over all Europe, and it certainly is a queer coincidence, that at the same period when Secretary Thielen, in whose sphere of administration gas-light is exclusively employed, proclaimed himself against the electric system, the General Direction of the State Railroads of Denmark resolved to introduce electric car-lighting on all their lines. All the railroads on the isle of Zealand, on which Copenhagen is situated, have already electric light. A few days ago we have received orders to furnish the storage batteries for lighting the trains on all the lines of the islands Falster and Fuhnen. At the same time they have resolved to establish a charging station for storage batteries at Struer in Jutland, to enable them to begin next year with the introduction of electric car-lighting on all the lines in Jutland.

The railroads in Switzerland will now adopt electric car-lighting, following the example of the Jura-Simplon Railroad, so that in a few years all cars on the Swiss railroads will be provided with electric light.

Almost all the private railroads of Sweden and Norway have electric light, also many German and Austrian private railroads, for instance the Dortmund-Gronau-Enscheder, the Provincial Railroad of Westphalia, the Altdamm-Colberg, the Marienburg-Mlawka, the Prignitzthal, the Mecklenburg Frederic-William, the Wittenberg-Perleberg, the Arad-Czanad, etc. The Emperor Ferdinand Northern and the Royal Hungarian Railroad introduce the system more and more. While in the beginning of 1896, in all Europe about 2,000 cars had electric light, there must be now more than 6,000.

DR. M. BUETTNER.

Stresses in Rails Under Moving Loads.

Mr. P. H. Dudley, in the course of his ceaseless efforts to learn and develop the physics and mechanics of the rail, has contrived an arrangement which he calls the stremmatograph. In a recent lecture before the New York Academy of Sciences he showed some of the records obtained with this device, and briefly described its principle and use.

The principle of the stremmatograph is to record on a moving metallic strip the molecular compression or elongation of the metal in a given length of the base of the rail, induced by the stresses produced by each wheel of the moving trains under the many conditions of the service. These records can be measured by filar micrometers under a microscope, and then from the modulus of elasticity of the steel we may compute the stresses which produce the given compression or elongation per square inch of the extreme fibers in the base of the rail.

The object of the stremmatograph is to convert rails of any section and weight, of any system of permanent way construction, into testing machines in the track, and show how much they are stressed due to the wheel loads and spacing of any type of locomotives and cars moving over the rails at the different speeds of service. It is to replace what is now mere conjecture by reliable information.

The picture on the screen [not reproduced.—Editor.] shows the first form of the stremmatograph attached to the base of the rail and under the front driver of the freight mogul engine No. 596, of the New York Central & Hudson River Railroad. It is on the eastbound, or track No. 1; 5⅛-in. 80-lb. section; outside rail on a 3-deg. curve and down grade of 10 ft. per mile. The ties are yellow pine 7 by 9 in. and 25-in. centers; gravel ballast; the tracks being in good condition. A number of tests of passenger trains were made under the same rail. The experiments made on track No. 2 were directly opposite, the rail being the inside one of the curve. The section was the 5-in. 80-lb. model of 1883; the rails were rolled in 1890 and all straightened on narrow suports in the mills; were heavily gagged and had a wavy surface.

The rails on track No. 1 are much smoother, the supports in the straightening presses having been made wider apart. On track No. 1 two experiments were made with locomotive No. 596, one at a speed of two miles an hour and one at ten miles an hour. The total weight of the locomotive was 96 tons; the engine 60 tons, with 15,500 lbs. on pony truck and 104,500 lbs. on three pairs of drivers. The tender weighed 72,000 lbs., or 9,000 per axle. It had been recently through the shops for general repairs, the tires of the drivers having been turned the same as when new. The tender wheels were new cast iron chilled wheels 33 in. in diameter and unground.

At a speed of two miles an hour the locomotive passed over the rail to which the stremmatograph was attached, the steam having been shut off a few feet before reaching the instrument.

The record of the molecular compression and elongation of the metal due to the stresses in the base of the rail was very smooth and distinctly delineated.

For the unground tender wheels slight tremors in the rail were distinctly indicated, a fact previously noticed under switching locomotives with the same class of tender wheels running over very light rails in the yard.

The apparent mean stresses for the extreme fibers of 5 in. in length of the base of the rail, computed on a basis of 30,000,000 lbs. for the modulus of elasticity of the steel, were as follows:

	Two miles an hour.	Ten miles an hour.
Compression in front of pony truck..	1,417 lbs.	1,653 lbs.
Tension under pony truck............	7,086 "	7,558 "
Compression between pony wheel and front driver	2,129 "	4,724 "
Tension under front driver...........	10,629 "	9,448 "
Compression between front and middle driver	5,433 "	8,031 "
Tension under middle driver..........	5,905 "	4,960 "
Compression between middle and rear driver	4,015 "	5,673 "
Tension under rear driver............	9,376 "	9,648 "
Compression between rear driver and first tender wheel..............	4,015 "	5,473 "

For the speed of ten miles an hour the locomotive was working under steam and being accelerated as it passed over the instrument modified the wheel pressures to some extent.

The tremors from the tender wheels were very decided in this run, and were felt for the entire length of the rails. The fiber stresses in tension are small for the loads upon the drivers even for an 80-lb. rail, while those in compression are higher than usual for the same weight of rail. The section is 5⅛ in. high and the stiffest 80-lb. rail which has been rolled in this country.

There is also another reason for the nearly balanced stresses. The two ties between which the stremmatograph was attached to the rail were very firm in the ballast, and to the eye did not seem to depress as much as those on either side; therefore, the compression stresses should be higher than on ties all practically depressing alike in the ballast.

Under locomotive No. 1, at Grand Central Station [switching engine], having 125,000 lbs. upon drivers, the instrument between ties of 30-in. centers, having tie plates, the apparent mean stresses were as follows, on 65 and 100-lb. rails, respectively:

	65-lb. rail.	100-lb. rail.
Compression in front of driver.......	3,071 lbs.	1,181 lbs.
Tension under front driver	51,964 "	8,031 "
Compression between front and middle driver	2,124 "	2,834 "
Tension under middle driver	22,445 "	6,849 "
Compression between middle and rear driver	2,362 "	2,834 "
Tension under rear driver.............	23,856 "	6,142 "

The 65-lb. rails are of recent composition, the elastic limit of the steel being 60,000 lbs., while on the 100-lb. rails it is 65,000 lbs.

In the above table it is interesting to note the great reduction and more uniform fiber stresses in the 100-lb. rails as compared with those in the 65-lb. rails. The 65-lb. rails require from six to eight times as much labor to keep them in surface as the 100-lb. rails in the Grand Central yard.

Another record is for the 5-in. 80-lb. rail on inside of curve, as already described in track No. 2. The rail has a very wavy surface, the stresses being largely augmented, owing to that feature. [This record is given in full for the train in the table at the end of this article.—Editor.] On the wavy surface of the rail on which these records were taken the combined static and dynamic effects in producing stresses are about double at 40 miles per hour of the static effects from the same wheel loads. This rate is much higher than has been found upon smooth rails. The importance of having the rails well finished, as we have compelled the mills to do for some years, is very fully confirmed. The necessity of having smooth wheels, perfectly round, is very important, particularly for fast trains.

In a number of records on the same rail the engines, when using steam to accelerate the train, the front driver has shown greater stress than the rear driver, except in one instance. The position of the counter-balance in all these experiments has been noted by the eye, and up to 35 miles per hour it has not made any noticeable difference in the stresses whether it was up or down on the N. Y. C. & H. R.

R. R. locomotives designed for the high-speed trains. This statement must only be taken as applying to the conditions under which these experiments have been made.

Stresses in track No. 1, 5⅛-in. 80-lb. rail, engine No. 901, with train; speed 20 miles an hour:

Compression in front of pilot	2,362 lbs.
Tension under front truck wheel	11,574 "
Compression between truck wheels	4,724 "
Tension under rear truck wheel	6,849 "
Compression between truck and front driver	5,905 "
Tension under front driver	12,046 "
Compression between front and rear driver	9,448 "
Tension under rear driver	14,172 "
Compression between driver and tender wheel	3,779 "

The rail in this case is the outside one on the curve, and in a number of records the stress under the front truck wheel of passenger locomotives have been much higher than in the rear wheel of the same truck, especially on outside rail on a curve. In static tests the front truck wheel almost invariably shows larger proportional stress than the drivers.

Stresses in 100-lb. rail under the "Empire State Express" engine No. 870 and four cars, leaving Grand Central yard, speed 10 miles an hour:

Compression in front of pilot	1,322 lbs.
Tension under front truck wheel	5,947 "
Compression between truck wheels	1,652 "
Tension under rear truck wheel	3,304 "
Compression between truck and front driver	3,139 "
Tension front driver	8,425 "
Compression between drivers	2,478 "
Tension rear driver	6,443 "
Compression between driver and tender truck	3,965 "
Tension front tender wheel	4,460 "
Compression between truck wheels	1,487 "
Tension rear tender wheel front truck	4,460 "
Compression between trucks	2,979 "
Tension front wheel rear truck	4,130 "
Compression between wheels	1,156 "
Tension rear wheel rear truck	3,469 "

The rail was the outside one on a 3-deg. curve; stone ballast; oak ties with tie plates—24-in. centers. The marked reduction in the stresses on the 100-lb. rails is very plainly seen.

The following records are for entire trains, and are the first that Mr. Dudley has worked out for the whole train. They were taken at West Albany (N. Y. C. & H. R. R. R.), Sept. 30, 1897:

Five-inch 80-lb. rail, ties 25-inch centers. Train No. 5, locomotive No. 888, Class I., drawing five Wagner palace cars, all 6-wheel trucks, speed 40 miles an hour. The rising of the rail in front of the truck wheel is plainly seen on the records. The apparent mean extreme fiber stresses per square inch in five inches of the length of the base of the rail were as follows:

Truck.	Pounds.
Compression in front of truck wheel	1,417
Tension under front truck wheel	13,070
Compression between front and rear truck wheel	3,069
Tension under rear truck wheel	12,579
Compression between rear truck wheel and front driver.	5,433
Drivers.	
Tension under front driver	31,415
Compression between front and rear driver	2,126
Tension under rear driver	26,456
Compression between rear driver and front tender wheel	2,362
Tender.	
Tension under front tender wheel	12,755
Compression between front truck wheels	1,181
Tension under rear tender wheel front truck	13,463
Compression between front and rear truck	2,362
Tension under front tender wheel rear truck	12,991
Compression between front and rear wheels	1,889
Tension under rear tender wheel	12,755
Compression between rear tender wheel and car wheel.	709
First Car.	
Tension under front car wheel	14,408
Compression between front and middle wheel	1,181
Tension under middle wheel	14,172
Compression between middle and rear wheel	3,443
Tension under rear truck wheel	13,224
Compression in rear of wheel	472
Compression in center of space between trucks	0
Compression in front of first truck wheel	945
Tension under front wheel	11,337
Compression between front and middle wheels	2,362
Tension under middle wheel	12,282
Compression between middle and rear wheels	1,181
Tension under rear wheel	12,046
Compression between trucks of first and second cars	2,362
Second Car.	
Tension under front wheel of truck of second car	9,684
Compression between front and middle wheel	1,181
Tension under middle wheel	14,172
Compression between middle and rear wheel	2,126
Tension under rear wheel	13,463
Compression in rear of wheel	2,126
Compression in center of space between trucks	0
Compression in front of wheel of rear truck	3,071
Tension under front wheel	12,046
Compression between front and middle wheel	1,181
Tension under middle wheel	13,227
Compression between middle and rear wheel	2,126
Tension under rear wheel	11,810
Compression between trucks of second and third cars	3,071
Third Car.	
Tension under front wheel of third car	14,172
Compression between front and middle wheel	1,653
Tension under middle wheel	15,589
Compression between middle and rear wheel	708
Tension under rear wheel	14,644
Compression in rear of wheel	1,890
Compression in center of space between trucks	472
Compression in front of wheel of rear truck	2,126
Tension under front wheel of rear truck	9,448
Compression between front and middle wheels	1,653
Tension under middle wheel	9,448
Compression between middle and rear wheels	3,071
Tension under rear wheel	9,920
Compression between trucks of third and fourth cars	2,598
Fourth Car.	
Tension under front wheel of fourth car	14,172
Compression between front and middle wheel	1,890
Tension under middle wheel	12,754
Compression between middle and rear wheel	2,824
Tension under rear wheel	13,227
Compression in rear of wheel	2,824
Compression in center of space between trucks	472
Compression in front of truck wheel	2,362
Tension under front wheel	10,393
Compression between front and middle wheel	2,834
Tension under middle wheel	11,574
Compression between middle and rear wheel	2,834
Tension under rear wheel	10,157
Compression between truck of fourth and fifth cars	4,960
Fifth Car.	
Tension under front wheel of fifth car	16,534
Compression between front and middle wheel	1,653
Tension under middle wheel	15,117
Compression between middle and rear wheel	1,653
Tension under rear wheel	15,825
Compression in rear of wheel	2,126
Compression in center of space	236
Compression in front of wheel	2,126
Tension under front wheel	10,393
Compression between front and middle wheel	1,653
Tension under middle wheel	12,046
Compression between middle and rear wheel	1,653
Tension under rear wheel	14,408
Compression in rear of wheel	1,417

Instrument returned to Zero after passage of train.

Train No. 45. Locomotive No. 889 and 7 cars, speed 30 miles an hour. The apparent mean stresses for the entire train being as follows:

Truck.	Pounds.
Compression in front of truck wheel	945
Tension under front truck wheel	7,558
Compression between front and rear truck wheel	1,181
Tension under rear truck wheel	7,758
Compression between truck wheel and front driver	1,890
Drivers.	
Tension under front driver	25,037
Compression between drivers	4,724
Tension under rear driver	16,298
Compression between rear driver and front wheel of tender	3,307
Tender.	
Tension under front tender wheel	8,267
Compression between tender wheel and front truck	2,598
Tension under rear tender wheel front truck	9,448
Compression between front and rear tender truck	4,015
Tension under front tender wheel rear truck	9,920
Compression between wheels of rear tender truck	4.015
Tension under rear tender wheel	11,337
Compression between tender wheel and front car wheel.	2,834
First Car.	
Tension under front wheel of car truck	10,864
Compression between front and rear wheels of truck	2,598
Tension under rear wheel of truck	10,157
Compression back of wheel	1,890
Compression in center of space between trucks	236
Compression in front of wheel of rear truck	1,417
Tension under front wheel of truck	10,393
Compression between front and rear wheel	2,126
Tension under rear wheel of truck	10,157
Compression between trucks of first and second cars	3,307
Second Car.	
Tension under front wheel of second car	11,101
Compression between front and rear wheel	3,071
Tension under rear wheel of truck	13,935
Compression back of wheel	1,181
Compression in center of space betwen trucks	236
Compression in front of wheel of rear truck	2,362
Tension under front wheel of rear truck	10,393
Compression between front and rear wheel	3,779
Tension under rear wheel	10,157
Compression between trucks of second and third cars	3,543
Third Car.	
Tension under front wheel of third car	8,976
Compression between first and middle wheel	2,362
Tension under middle wheel	10,393
Compression between middle and rear wheel	2,126
Tension under rear wheel	10,157
Compression back of wheel	2,126
Compression in center of wheel space	236
Compression in front of wheel of rear truck	1,181
Tension under front wheel of rear truck	9,448
Compression between front and middle wheels	2,126
Tension under middle wheel	12,046
Compression between middle and rear wheel	1,181
Tension under rear wheel	12.046
Compression between trucks of third and fourth cars	945
Fourth Car.	
Tension under front wheel of front truck	13,463
Compression between wheels of truck	3,071
Tension under rear wheel	15,825
Compression back of wheel	709
Compression in center of space between trucks	0
Compression in front of front wheel of rear truck	1,417
Tension under front wheel	16,770
Compression between front and rear wheels	1,653
Tension under rear wheel	14,408
Compression between trucks of fourth and fifth cars	708
Fifth Car.	
Tension under front wheel of fifth car	9,920
Compression between front and rear wheel of truck	1,890
Tension under rear wheel of front truck	10,393
Compression back of wheel	1,181
Compression in center of space between trucks	0
Compression in front of wheel of rear truck of fifth car.	1,181
Tension under front wheel of rear truck	7,558
Compression between front and rear wheel	1,181
Tension under rear wheel	8,503
Compression between trucks of fifth and sixth cars	1,181
Sixth Car.	
Tension under front wheel	9,212
Compression between front and middle wheel	945
Tension under middle wheel	11,101
Compression between middle and rear wheel	1,653
Tension under rear wheel	9,920
Compression back of wheel	708
Compression in center of space between trucks	0
Compression in front of front wheel of rear truck	1,181
Tension under front wheel of rear truck of sixth car	9,448
Compression between front and middle wheel	2,834
Tension under middle wheel	11,101
Compression between middle and rear wheel	2,834
Tension under rear wheel	12,519
Compression between trucks of sixth and seventh cars	2,834
Seventh Car.	
Tension under front wheel of seventh car	11,101
Compression between front and rear wheel of truck	708
Tension under rear wheel	10,865
Compression back of rear wheel	708
Compression in center of space between trucks	0
Compression in front of wheel of rear truck	2,126
Tension under front wheel	13,227
Compression between wheels	1,417
Tension under rear wheel	13,227
Compression back of wheel	708

Instrument returned to zero after passage of train.

Convention of Railroad Commissioners.

The tenth annual convention of State Railroad Commissioners was held in Washington, D. C., May 10 and 11. Commissioners were present from 32 States, and there were four representatives from the Association of American Railway Accounting Officers. Mr. Davidson, of Iowa, chosen last year as Chairman, is now dead; the Vice-Chairman, Mr. La Rue, of California, was absent, and Mr. C. J. Lindley, of Illinois, was elected Chairman. W. W. Ainsworth, Secretary of the Iowa Commission, was elected Vice-Chairman.

The first session was taken up with addresses by M. E. Ingalls, President of the Cleveland, Cincinnati, Chicago & St. Louis, and E. E. Clark, Chief of the Order of Railway Conductors.

Mr. Ingalls, after describing the very unfavorable financial results of the rate demoralization that has existed in the principal railroad fields during the past few years, said:

There is a much more dangerous aspect, and that is, the demoralization of the men conducting these immense enterprises and the want of respect for law which is being developed by the present situation. The trouble is not due altogether to the provisions of the Interstate Commerce law. It has grown up from various sources. The panic of 1893, and the loss of business for the next few years, intensified the competition bet[illegible] lines. New avenues were opened; the [illegible] th[illegible] Gulf ports increased enormously; also [illegible]nadian Pacific on the north. Altogether, these causes produced such sharp competition, coupled [illegible] the Supreme Court decision, that no understand[illegible] or agreements can be made, and have combin[illegible] produce the most complete breakdown that has ever been seen in any business. There is less faith to-day between railway managers with reference to their agreements to maintain tariffs than was probably ever known on earth in any other business. Men managing large corporations, who would trust their opponent with their pocketbook with untold thousands in it, will hardly trust his agreement for the maintenance of tariffs while they are in the room together. Good faith seems to have departed from the railway world, so far as traffic agreements are concerned.

One of the chief difficulties of the law as it stands to-day is that the punishment for private contracts and rebates is entirely out of proportion to the offense. The imprisonment clause has been a failure, more than a failure, for it has caused, perhaps, more demoralization than anything else. It has prevented the railway official who desired to be honest from complaining of his competitor whom he thought was dishonest. In fact, it has been what every law is that is not supported by public sentiment—a failure. What, in fact, is the manner [illegible] conducting business to-day? The railway official who desires to be honest and law-abiding sees traffic leave his line, the earnings of his line decreasing, and complaints from the management of loss of earnings, and in the distance he sees looming up the loss of his position. At the same time the shipper who desires to obey the law sees some rival selling merch[illegible]ise to his customer at prices he cannot meet, and [illegible]nows very well that he is securing concessions fr[illegible] some railway to enable him to do this. The railway agent and the shipper who wish to obey the law sit down together and look it over. What relief is there for them? They can complain of their rivals, possibly convict them under the Interstate Commerce law, and send them to the penitentiary, but such action would bring down upon them the condemnation of the public, and would ruin their business, for, as I stated before, the public does not believe in the severe features of the law, and will not support any one who enforces it. The result is, these men in despair are driven to do just what their opponents are doing. They become law-breakers themselves. I have drawn no fancy picture; it is what is occurring every day around you. Boards of trade, commercial bodies and conventions have repeatedly reported on it, and all have come to the same conclusion, and yet, for some inexplicable reason, Congress has failed to act.

The tenth section, or imprisonment clause, of the law should be stricken out, and a new law should be enacted imposing a fine of, say, $5,000 upon the offending corporation; make each and every contract or bill of lading a separate offense. Leave out the shipper altogether; you want his testimony. If he cheats by underbilling or false invoices, he should be punished, but his attempt to secure a lower rate than his rival should not be indictable, as you then prevent getting testimony which you need. With this amendment put into law, every railway official will be interested in prosecuting his rival for any violation of the law.

No one is going to try to send his competitor to prison. Besides, there is the fear that he himself may have committed transgressions which in turn will be discovered and prosecuted and punishment inflicted upon himself. But, if it was a case of fine against the corporation, there would be no hesitation in these corporations using the entire power which they have to convict wrongdoing. You may think that some would pay these fines and go on, but I assure you that a few fines of $5,000 would work wonders in reforming railway corporations in their management. Above all, you will have public opinion behind you, and it will be easy to enforce this law. You can get all the testimony you want; no one can refuse to produce his books. You will at least give those railway officials and those shippers who sincerely desire to be law-abiding citizens a fair chance to defend themselves.

Second, the law should be amended so that railway corporations can contract with each other for the maintenance of rates or the division of business, and in case of failure of either party to keep his contract allow the other to sue in the courts and recover damages. This, in part, is what is called pooling, but it is more than this. It legalizes contracts between railway corporations. It may be a contract for maintenance of rates with no division of business. To-day, if two railway corporations contract that they will maintain the same rates between Baltimore and New York, it is a conspiracy, contrary to public policy, and cannot be enforced in the courts.

Who oppose this proposed legislation? First, certain people who desire the Government to own and operate the railways; second, others who wish that the Interstate Commerce Commission should make all rates; third and lastly, certain railway managers who are opposed to any and all legislation, and who object to any control, and believe that they should be left entirely alone. As to the first, very few people are ready to launch the Government into the management of 185,000 miles of railway and the employment of 1,000,000 men. The second and third represent opposite extremes. Is it not better for us to take a medium course? Making rates for the whole country is too prodigious a task for any one set of men, be they never so wise. On the other hand, the railroad manager who claims the right to act independently of all State control is 25 years behind the times. . . . A very large majority of railroad managers believe that the two provisions I have mentioned are necessary and will lead to the settlement of this question. If this body will join and heartily indorse this course and work for it, its accomplishment can be attained.

. . . Our transportation problem must be worked out in harmony with the age and with the needs of the country. There should be no friction between the Interstate Commerce Commission and the railways; there should be none between the State Commissions and the railways. The problem can be met in no better way than by the two methods I have pointed out. First, the change of the criminal section; second, authority to contract and divide business. Either one of them would be of great advantage, but we ought to have both. There should be such legislation as will give more force to the recommendations and orders of the Interstate Commerce Commissioners. Instead of trying to break down the Commission, the railway officials should try to build it up, should make the Commission its aid, and use it as a bulwark

of strength in Congress and in the States to beat back the tide of Populism that is rising continually against them.

Unless some change is made, the small shippers of the country will be extinguished, and a few men of large capital will control the entire merchandise business. They have such facilities, through commissions, agencies, ownership of private cars, for evading the law that no moderate shipper can for a moment compete with them. Is it wise for any country to aid in such a destruction? Is it not suicidal to all our material interests? The railways themselves in their insane competition will at last get so low that they will be seized upon by large capitalists and combined into one monstrous company. Already, since the interstate commerce law, there have been more consolidations of rival and competing lines than in the twenty-five years previous. This is not for the interest of the public. You must further remember that this immense industry cannot be run by iron rules. There must be some opportunity for the development of traffic. There must be some freedom given the managers in the proper way to increase the business of their lines. You hear objections that agreements to divide the business will produce rates that will be destructive to the business of the country. The answer to them is that no pool can be made large enough to control the business of the country as against the different markets. . . . Comparisons with England are idle. We have so much greater mileage, and such an enormous country, that what possibly might work there would be destructive here. We must work out the transportation interest on our own lines, and adapt it to our own country.

There will be some people oppose them for selfish interest, or for political reasons; but why, in reference to such an enormous interest as this, wait for every one to agree? Take what the great mass of thinking men, what you yourselves approve, and put it into the shape of a law, and let us try it.

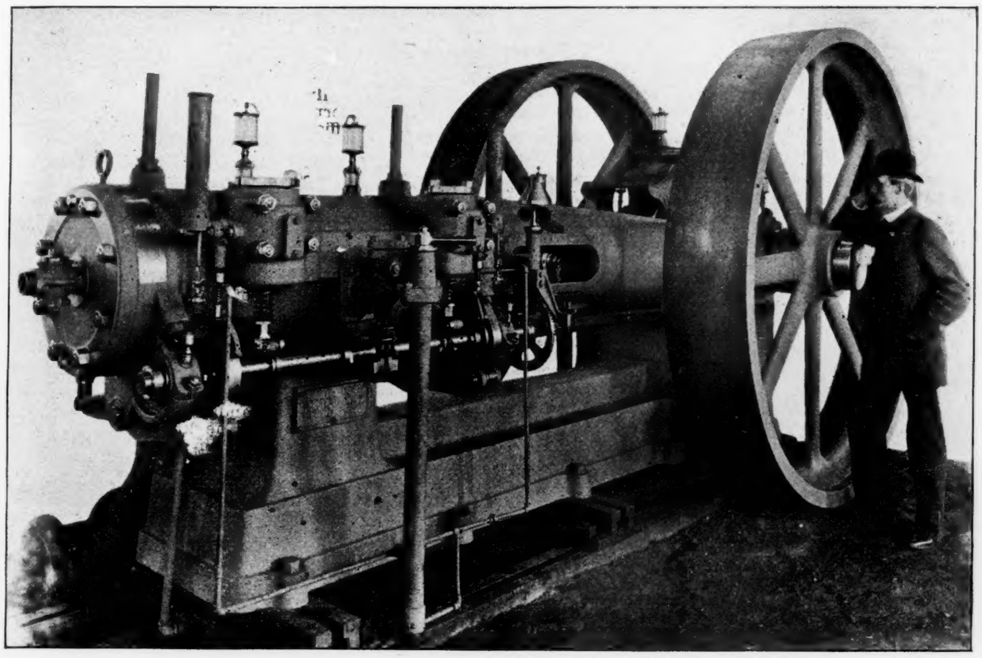


Fig 1.—The American-Kilmarnock 100-B. H. P Gas Engine, Built by the Wes'ern Gas Construction Co., Fort Wayne, Ind.

The American-Kilmarnock Gas Engine.

The "American" engine is a modification of the Kilmarnock engine made by Messrs. Dick, Kerr & Co., Ltd., of London, England, modified to meet the requirements of American practice. These engines, made for the American market by The Western Gas Construction Co., of Fort Wayne, Ind., have been in successful operation for a number of years and are examples of a carefully designed machine.

These engines have the front end of the cylinder closed in and used as a power chamber the same as the back end, so that this end produces the same power as is produced at the other end, less the amount lost due to the area of the piston rod. The Kilmarnock engine has been in use in England for about 10 years, where large sums had been spent in perfecting the machine as now placed on the market, the largest single cylinder engine being 300 H. P. and 600 H. P. in a coupled engine. One of the principal parts of the engine to which considerable attention has been given is a perfected stuffing box capable of withstanding the heavy pressures of explosion and the heat developed.

Up to the present time no smaller than 15 H. P. engines or larger than 100 B. H. P. have been built in the United States. The engines which have been turned out in this country have been and are performing their work satisfactorily.

In undertaking the building of gas engines to drive dynamos, the company determined that all such mechanisms as jack-shafts with heavy flywheels and balance wheels on the generators and elsewhere would be inadmissible in a first-class plant as their use implied an incomplete or defective design. To belt direct from the engine to the generator or dynamo the engine itself must run without pulsation. The primary means of power in the gas engine allows but one working impulse in four strokes, hence there are three idle ones. The impulse from the explosion produces a sudden, high pressure, which rapidly decreases; therefore, the designer must deal virtually with a blow differing entirely from the steady push in a steam engine cylinder. This produces a cyclical variation in speed, and to overcome this there must be mass in the engine itself and a sufficiently heavy flywheel. In the Double Acting type two impulses and two idle ones are secured by having the cycles on the front and back end work in with each other. To reduce power in the engine it is necessary to cut out, that is, prevent an entire impulse. On this principle the "American" engines are built apparently very heavy, the weight of a 100 B. H. P. engine complete being about 32,000 lbs., and much care is taken in the design and workmanship in every detail. The governing also is susceptible of very much closer regulation even with ordinary methods, owing to a cut-out (except on entire throw-off of load) affecting but one end, thereby still allowing down to about one-half load a steadiness equal to a single-acting engine on full load.

One of the most interesting installations is at Lancaster, O., where a 100-B. H. P. engine, similar to that shown in Fig. 3, has been in constant operation since July, 1896, averaging something over 15 hours a day. A record of the volt and ammeter is given in the accompanying diagram, Fig. 4, which shows the variations in the regular load at Lancaster. The engine regulates on an average within 5 volts from the set voltage of 505. The small amount of variation—which is guaranteed under any conditions whatever—is due largely, if not entirely, to the type of governor which was recently devised. The Superintendent of the Columbus (O.) Street Railroad, Mr. W. F. Kelly, who has charge of the Lancaster road, states that he considers the regulation superior to that of any steam engine of the same power on the same duty. In connection with the principle adopted it was essential that the governor must be so sensitive that it would positively prevent the engine from taking in a charge on any fall of the load, no matter how sudden, and similarly must positively insure that a charge would be taken on a sufficient increase of load. The outside limits of variation in speed of the engine, within which the governor must be depended upon positively to control the admission valve, was placed at less than one-half of one per cent. With such a combination, the fly-wheels would never be called upon to absorb the effect of an entire impulse after the load had been taken off. After about two years of very costly experimental work such a governor was devised, and patents for it were issued in December last.* The combination produces a motor guaranteed to regulate within four per cent. extreme variation under any conditions whatever of load. Actual tests have shown a regulation within one per cent. on a fairly steady incandescent lighting service and three per cent. on a street railroad load; these tests being made under ordinary working conditions, no special preparation being made for them. The latest type of this governor is shown in the accompanying engraving, Fig. 2, being mounted independently of the engine proper, and belted direct to the crank shaft. The earlier designs were mounted upon the engine proper, as shown in Fig. 3, the change to independent setting having been made to avoid the fluctuation due to the torque of the cam shaft and the back-lash of its gearing. The valve controlling the gas admission has a

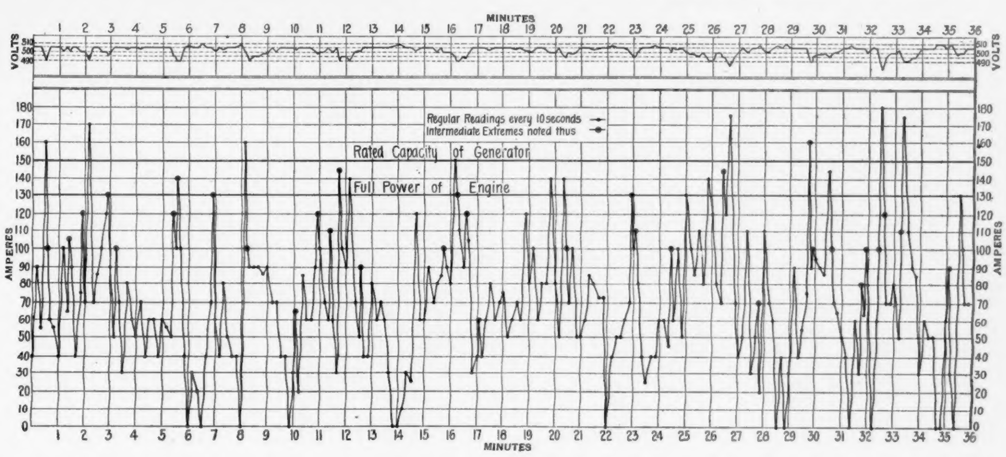


Fig. 4.—Volt and Ampere Reading on Lancaster, O, Electric Road—75 K W. Generator, Driven by Gas Engine.

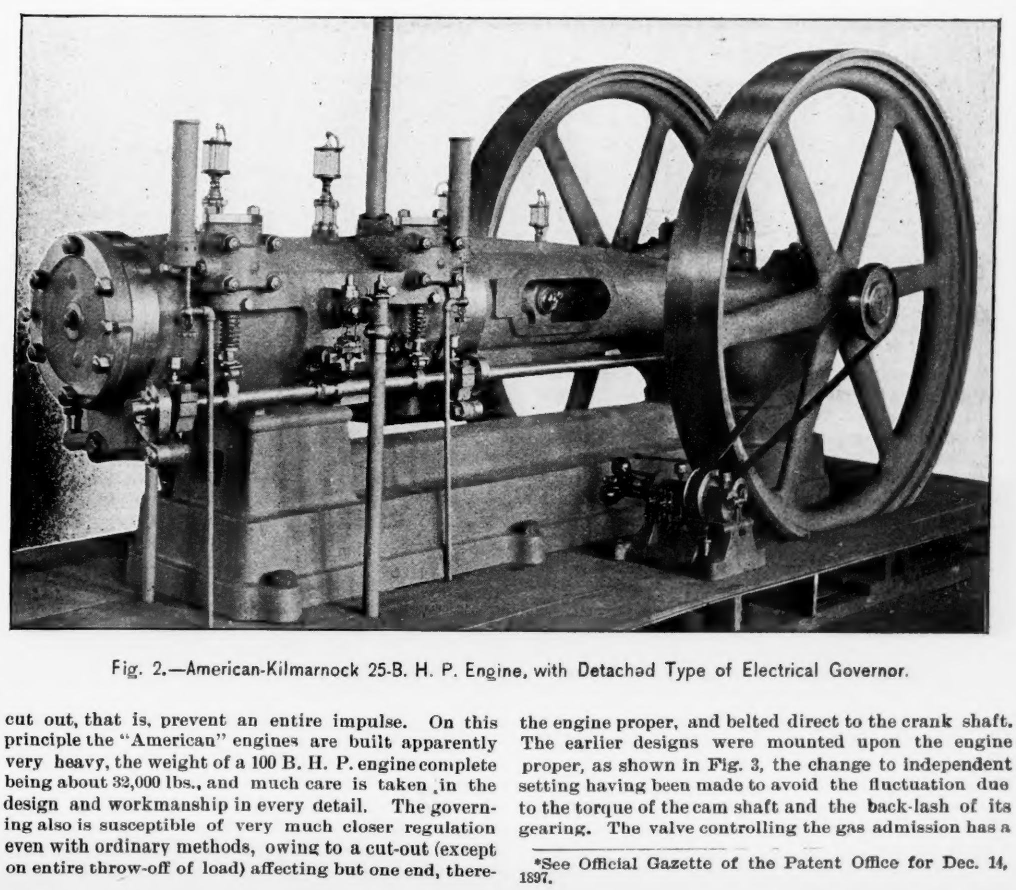


Fig. 2.—American-Kilmarnock 25-B. H. P. Engine, with Detached Type of Electrical Governor.

*See Official Gazette of the Patent Office for Dec. 14, 1897.

double swinging extension on the end, and these are permitted to swing about one-eighth to three-sixteenths of an inch, just enough to come in contact with and escape the ends of the lifting levers. These pivotal ends (see Fig. 1) are also in themselves armatures for the magnets controlled by the governor. Normally, these ends are kept outside of the reach of the lifting levers by means of a light spring, which pushes them over against an adjustable stop formed by a thumb screw with a lock nut. When the governor is in play, however, one or both of the magnets are energized as determined by the load, and attract the pivotal ends of the valve stem to them, which action is due to the speed falling the required amount, whereby the governor completes the energizing circuit. The principle on which this governor works is shown by the diagram, Fig. 5. The action is as follows: B is an electric battery, or shunt from the dynamo. When the mechanism is in the position as shown in the diagram, the magnets AA are so adjusted that the gas is admitted to both ends of the cylinder through valves which are normally closed, but mechanical means for a positive opening of the valves at the proper period in the cycle are provided. As the

and lift them up, thereby opening the valves. At such a time the blades move on the rollers mentioned, which are made of brass and do not hold the steel blades. The two thumb screws shown prevent the blades from flying too far back, but allow them to get just far enough away to clear the lifting levers, one of which is shown in such a position, the other being shown lifted somewhat, leaving the valve partly open. The springs which throw the pick blades out when the current is released are shown in both figures, being seen as bearing against the pick blades.

After passing through the inlet valve above described, the explosive mixture passes through the mixing chamber, thence through the admission valve shown in Fig. 3. This valve is also worked by a cam movement, and is opened every other revolution (or cycle), regardless of the action of the hit and miss gas admission valve, but is seated during the explosion or impulse stroke.

In Fig. 8 the exhaust valve and actuating mechanism are illustrated. This view gives a very good idea of the substantial construction of the supports for the actuating mechanism. The cams are so spaced

On the Wear of Steel Rails.

A recent issue of the Abstracts of Papers, published by the Institution of Civil Engineers (British), contains an abstract of a report by G. Olva, of observations on the life of rails in service. We regret that the report is not given at more length, but reproduce the essentials of the abstract.

Fracture of Rails.—Full particulars are given of the fractures of rails from July 1, 1885, to Dec. 31, 1895, on various lines of the company's system presenting the greatest variety of conditions of wear. On certain sections the number of fractures is very high; e. g., on the San Giuseppe & Bra line, on gradients steeper than 1 in 50 and on curves of less than 25 chains radius, the proportion per annum was 17.48 per mile; on the San Giuseppe & Savona line 14.81 per mile, and so on. The fractures occur either longitudinally or transversely. The former are generally fissures in the upper portion of the rail-head, and are due probably to defects in the metal. Transverse fractures are generally of much less frequent occurrence. Most of the recorded exceptions to this rule have been on the line from Bussoleno to Beau-

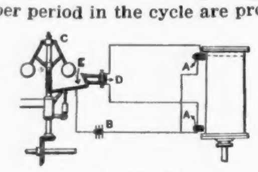


Fig. 5.—Electrical Governor.

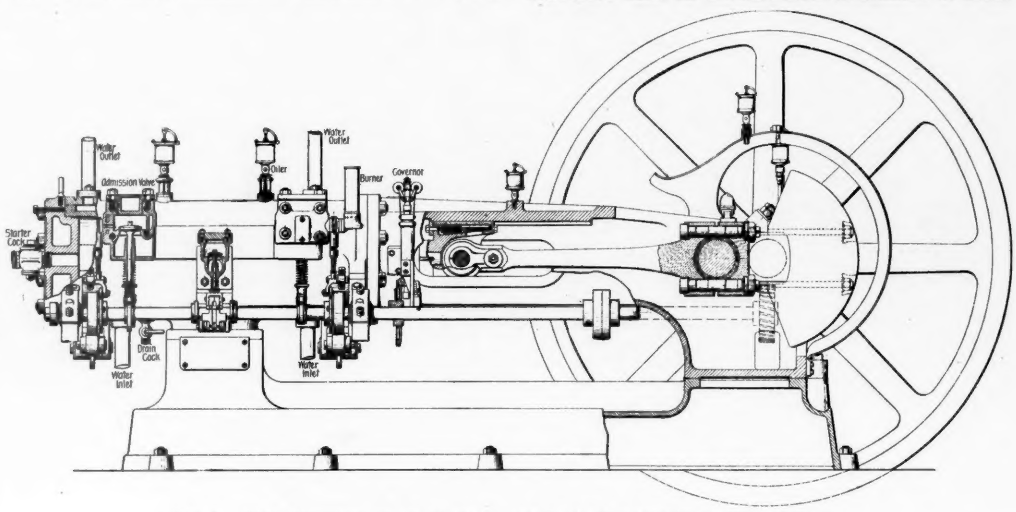
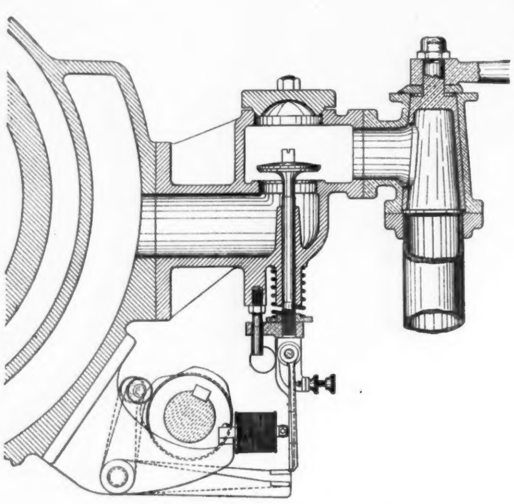


Fig 3.—Side Elevation of 16 × 20 in. 100-B. H. P. "American" Gas Engine.



Sectional View at Right Angles to Fig. 7.

Fig. 6.—Gas Inlet Valve, Lifting Device and Electrical Pickblade Regulator.

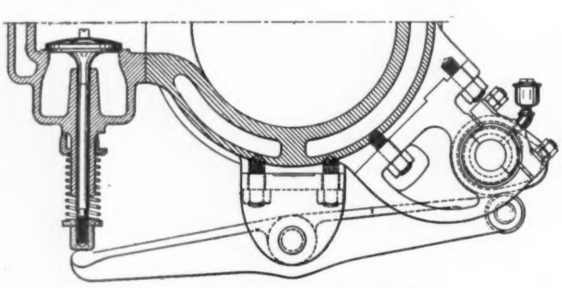


Fig. 8.—Exhaust Valve and Actuating Mechanism.

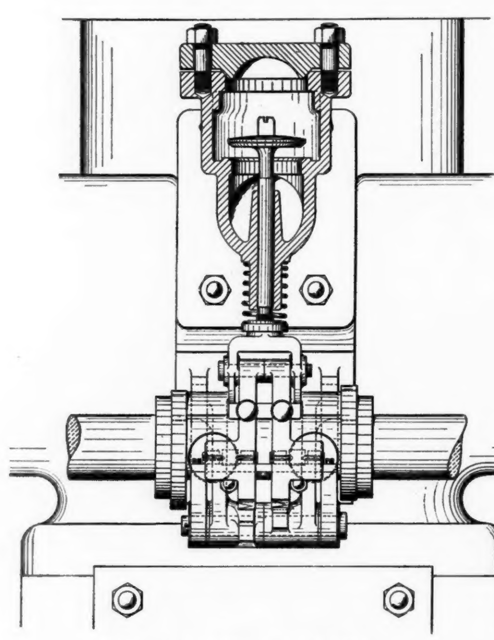


Fig. 7.—Front View of Inlet Valve.

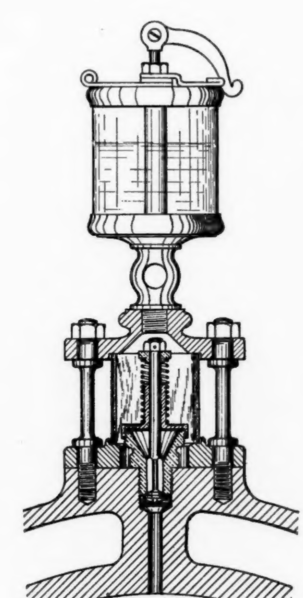


Fig 9.—Cylinder Oiling Device.

DETAILS OF KILMARNOCK-AMERICAN GAS ENGINE, MADE BY THE WESTERN GAS CONSTRUCTION CO., FORT WAYNE, IND.

speed increases the governor balls raise the sleeve and the end of the pivoted arm E by means of which, it will be observed by following the electrical connections, the current is cut off from the back end of the cylinder, and the gas can be admitted only to the front end. Should the speed increase until the rod E breaks connection with the second contact piece, which is fastened to the block D, then the gas is cut off also from the front end of the cylinder, due to the breaking of both the electric circuits.

As seen in Fig. 3, there are two admission valves, one of which takes in the gas before it passes to the mixing chamber, and to thoroughly understand the action of the governor, it will be necessary to describe in detail this valve, which is also shown in Figs. 6 and 7. The other valve is designated in Fig. 3 as "admission" valve. Referring to Figs. 6 and 7, the two pick blades form the armatures for the magnets seen in Fig. 6. The rollers in the ends of the magnet cores are also here shown, and are also shown by dotted lines in Fig. 7. When the current is on, the magnets (Fig. 6) draw the pick blades toward them, thus permitting the lifting levers to engage the pick blades

about the camshaft that they lift all the valves at proper moments. The construction of the end of the cylinder and arrangement of exhaust valve takes advantage of a known peculiarity of gases suddenly released into a long pipe in that they will "draw a vacuum" if the pipe is of a certain length and not too sharply bent. Therefore, by properly designing the end of the cylinder, it is possible to scavenge out the burnt gases.

In Fig. 9 is shown the cylinder oiling device. In the design used by these makers, the vacuum caused by the drawing in of the explosive mixture opens the reversed poppet valve, thus permitting a few drops to leak past, when the equilibrium of pressure is restored and the valve is raised by the spring on its stem back to its seat. In short, it is simply a method of equalizing pressures in order to make sure of a proper flow of the oil.

The above description does not pretend to enter into the economy of this engine. The progressive spirit shown by the Western Gas Construction Company in developing a new design and in exacting rigid requirements in their engines is commendable.

lard, which was one of the earliest sections laid with steel rails. In general, the transverse fractures begin to outnumber the longitudinal fractures when the rail is worn to nearly its fullest allowable extent.

Gradual Wear of Rails.—Apart from the mechanical action of work performed by the passage of the trains the principal causes of wear are the chemical action of the gases developed in imperfectly ventilated tunnels, and the corrosive action of the salt air on coast lines.

With regard to the mechanical element of wear, reference may be made to an appendix, where the wear for twelve months is shown, as well as that caused by the passage of 1,000 trains. Statistics are also given of the wear on various gradients and curves. The diagram shows clearly the effect of long tunnels, of stations, of the neighborhood of signals, etc., on the life of the rails. Apart from the abrasion of the rail-head, deterioration is evident on all parts of the permanent way at their surfaces of contact.

Chemical Action in Tunnels.—This action, due to the mixture of acid vapors and products of combustion from the locomotives, is most observable on

the underside of the flange of the rails, where a species of permanent layer of corrosive liquid is formed between the surface of the rails and that of the chairs.

Various instances of this are given in detail. On one of the rails (Vignoles type) on the descending line in the long Ronco tunnel, the corrosion of the flange in two-and-a-half years amounted, in various places, to 0.086 in. On the ascending line in the same tunnel the maximum flange corrosion after three-and-a-half years was, in some cases, as much as 0.22 in. to 0.26 in.; and after four years' wear 0.28 in. to 0.3 in. The corrosion had honeycombed the entire under-surface of the flange. Other examples are illustrated—from the Frejus tunnel, on the Turin and Modane line; from the Sella tunnel, on the San Giuseppe & Savona line; and from the Belbo tunnel, between San Giuseppe and Bra. In the Laveno tunnel, between Novaro and Pino, where transverse fractures necessitated the removal of various rail-lengths, a most extraordinary degree of corrosion was noted, amounting to 0.39 in. on the underside of the flange, while the abrasion of the head amounted (in the worst case) to 0.49 in., the rails having been laid eleven-and-a-half years.

Action of Sea Air on Coast Lines.—This source of corrosion has been chiefly observed on the Ligurian Riviera, where the line is not merely exposed to the salt air, but is frequently subject to drifts of spray from the waves. In such cases the rail frequently reaches its limit of safety long before the normal wear has been attained. For instance, on the Celle and Cogoleto section of the line from Genoa to Ventimiglia, the Vignoles rails, after fifteen years' service, showed a reduction of only 0.118 in. to 0.158 in. on the head, but were much corroded in the flange, frequently to the extent of 0.158 in. to 0.236 in.; while the width of the flange was correspondingly reduced by 0.39 in. to 0.6 in., and in some cases even 0.79 in.

Permanent Elongation and Deflection of Rails.—In addition to abrasion and corrosion, other destructive agencies may be noted.

On the Mont Cenis approach line, between Meana and Chiamonte, on a gradient of 1 in 34½, laid with Vignoles rails, it was found in several cases that the original clearance between the rail ends had entirely disappeared, and that one or both of the rails had extended longitudinally, pressing together, causing the head to bulge out—in one case to the extent of 0.39 in.—correspondingly decreasing in height and tightening the gauge by fully $\frac{5}{16}$ in. Between the points of support the rails were also conspicuously deflected, so that the number of supports could be counted by the successive curvatures or undulations of the rail. This was evidently due to the defective quality of the steel.

Methods Adopted for Diminishing the Wear or Deterioration.—During the past three years a harder steel has generally been specified than was formerly adopted. The old specification was, tensile strength 35 tons per sq. in. (sometimes even less), with minimum elongation 18 per cent. to 20 per cent. Except in special cases the normal tensile strength now required is from 41 tons to 44½ tons per sq. in., with minimum elongation 14 per cent. Experiments were also made with a view to the adoption of a rail not greatly exceeding in weight the old type, but with larger bearing surfaces. The width of the head is increased from 2.36 in. to 2.83 in., and the weight is 90¾ lbs. per lin. yd. The area of abrasion allowable is 2.23 sq. in., as against 0.72 in. in the old type.

Since the adoption of the new section, no instance of elongation or undue deflection has been noted, and the extent of abrasion has been considerably diminished. The new rails laid in the Ronco tunnel, for instance, in October, 1894, were examined in February, 1897, i. e., after two years and four months, and the reduction of the head amounted to only 0.118 in.

The results of the methods adopted for securing a diminution of chemical or corrosive action have not yet been demonstrated on a sufficiently reliable basis.

On the Celle and Cogoleto section of the Genoa & Ventimiglia line, some of the rails relaid in 1891 were coated with tar and with other ironwork varnishes. When examined in 1896 the results varied in different parts of the rail. The friction of the portions bedded in the ballast or in contact with the chairs and fastenings had naturally worn away the coating; but though rust was slightly formed, very little trace of corrosive action was observable. In the exposed portions the protective coating stood remarkably well.

Concurrently with this, a similar experiment was being made in the Frejus tunnel, and the rails were examined after an average wear of three years and eight months. The Bessemer varnish was found to have been the most effective coating; next to this being tar, two coats. Although the period was too short for the establishment of conclusive data, it appears to be distinctly proved that the small outlay for a protective coating is amply justified by the additional life and soundness of the rails.

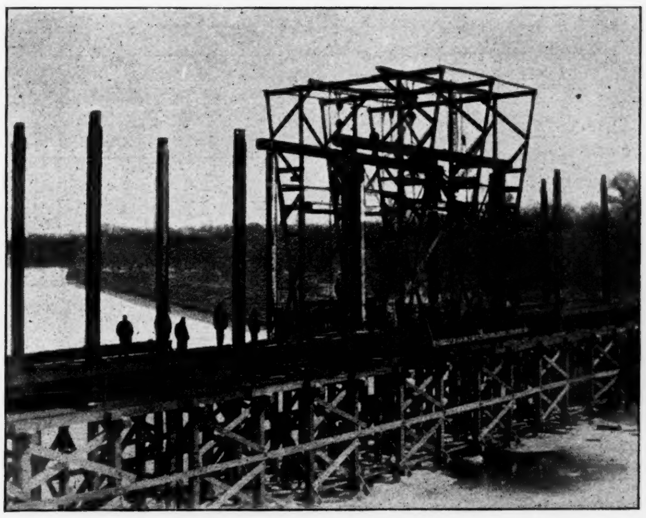


Fig. 4.

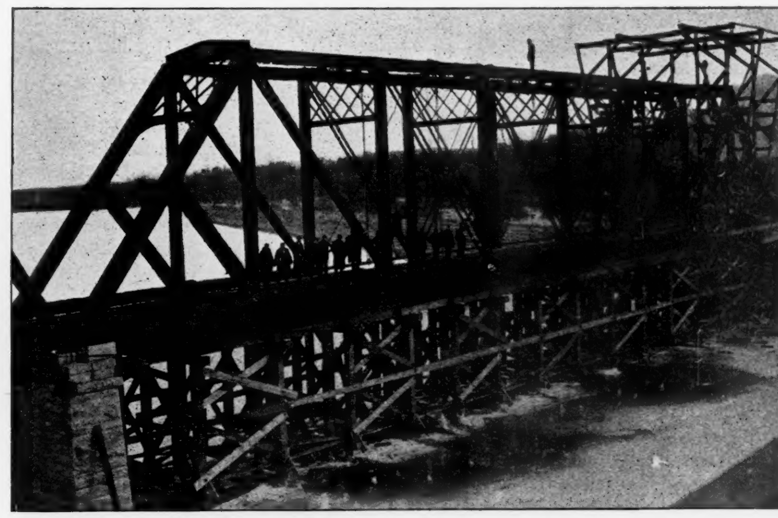


Fig. 5.

Span No. 1, Chicago & Northwestern Bridge, Clinton, Ia.

Reconstruction of the Chicago & Northwestern Bridge, Clinton, Iowa.

The Chicago & Northwestern Railway, as previously noted, has, during the past winter, replaced a number of important bridges at various points, and the accompanying engravings show the main features of the reconstruction of four fixed spans of the single track bridge over the Mississippi River at Clinton, Iowa. This bridge, at present, consists of one draw and twelve fixed spans, and, like most of the Mississippi River railroad bridges, has been rebuilt a number of times.

The river at this crossing is divided into an east and west channel by Little Rock Island. In 1860 the east channel was bridged by seven 200-foot spans of the McCullum patent truss. These spans were furnished by the patentee, Mr. D. E. McCullum, and the foundations and masonry were put in by Harper & Cross of Chicago, under the supervision of Mr. Milo Smith, Superintendent and Chief Engineer of the Chicago, Iowa & Nebraska Railway. The railroad traffic was carried over the west channel by a ferry until 1865. During 1864 and 1865 the west channel was bridged by three Howe truss spans and one 300-ft. draw span of the Bollman type of truss; the draw was furnished by the Detroit Bridge & Iron Works. These Howe truss spans were replaced in 1874 by iron spans of the Whipple type, made by the American Bridge Works, and the draw was replaced by a pin-connected Pratt truss draw span in 1887, furnished by the Detroit Bridge & Iron Works.

The reconstruction of this draw involved a rather novel piece of engineering work. Owing to the difficulty and danger of placing falsework in the river at this point, it was decided to erect the new draw up and down stream on the protection pier, leaving the old draw intact to carry the railroad traffic. When the new draw was completed, the two arms of the old draw were coupled together across the new draw and the latter was then swung in line with the railroad, thus bringing the old draw span in the position over the protection which the new draw occupied while being erected. This work was done under the direction of Mr. E. C. Carter, now Principal Assistant Engineer of the Chicago & Northwestern, but at that time Engineer for the Detroit Bridge Works.

The present work carried on during the past winter consisted in replacing with pin-connected Pratt in by the American Bridge Works. In 1870 the remaining six 200-foot spans in the east channel were removed and new piers built for eight 150-foot spans. These, with the exception of two spans, were pin-connected Pratt trusses, and the following bridge companies furnished two spans each: Detroit Bridge & Iron Works, Phoenix Bridge Co., and Keystone Bridge Co. The two exceptions were Post trusses and were furnished by the American Bridge Works. The first 200-foot span in the east channel was replaced in 1880 by Rust & Coolidge, with a Whipple truss, and during the years 1882 to 1885, the Lassig Bridge & Iron Works replaced the remaining eight 150-foot spans in the east channel, using pin-connected Pratt trusses. All this reconstruction was under the direction of Mr. John E. Blunt, the present Chief Engineer of the Chicago & Northwestern.

The present work carried on during the winter of 1898 consisted in replacing with pin-connected Pratt trusses the first span of the east channel, formerly a 200-foot Whipple truss, and the three fixed Whipple truss spans in the west channel. This last work was done under the direction of Mr. John E. Blunt, Chief Engineer; Mr. W. H. Finley, Engineer of Bridges, had charge of the designing of the bridges, and the plans for the falsework, while Mr. H. J. Slifer, Division Engineer, superintended the work in the field. The Detroit Bridge & Iron Works furnished the spans and erected them and the railroad company put in the falsework.

Fig. 1 shows the general outline of the old and new trusses, and the arrangement of the falsework, the old masonry piers and abutments being used for the new superstructure. It will be seen that there are two spans, 171 ft. 6 in. long, consisting of 7 panels each, one 196-foot span of 8 panels, and one 8-panel span 197 ft. 7½ in. long. All trusses are pin-connected. The strain sheet, Fig. 2, gives the stresses in the different members arising from the combined live and dead loads, the area of the cross-sections, and indicates how the various members are built up. The small diagram gives the arrangement of the

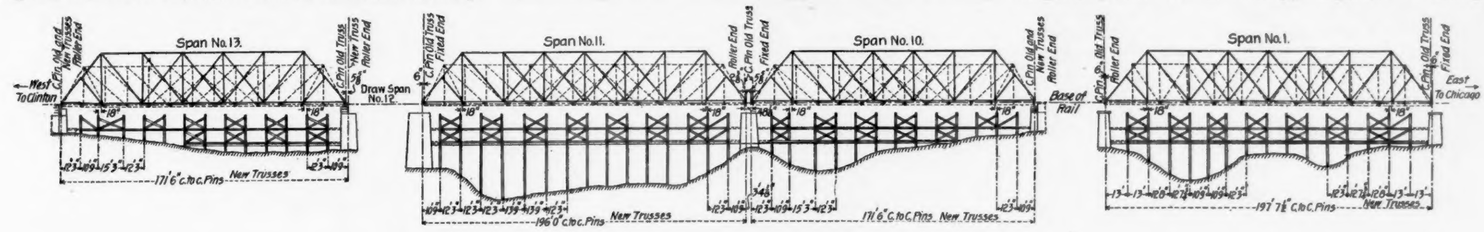


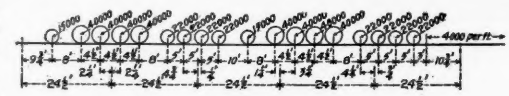
Fig. 1.—The Chicago & Northwestern Bridge at Clinton, Ia.

The old spans are shown in dotted lines.

wheel loads for two standard consolidation locomotives at the head of a train. The material used for the riveted members was soft steel, while medium steel was used for eyebars, and all holes were reamed in the bottom chord, floor system and their connections.

corbels were sawed off close to the main posts so as to allow room for the new floor beams to be dropped into place. In this way the erection progressed rapidly, as shown by the following record:

The new spans were erected without mishap and with little delay to traffic. During this time the average daily number of trains passing over the bridge was 33, while the maximum number for a single day was 44, and the minimum 25 trains.



Wheel Loads.

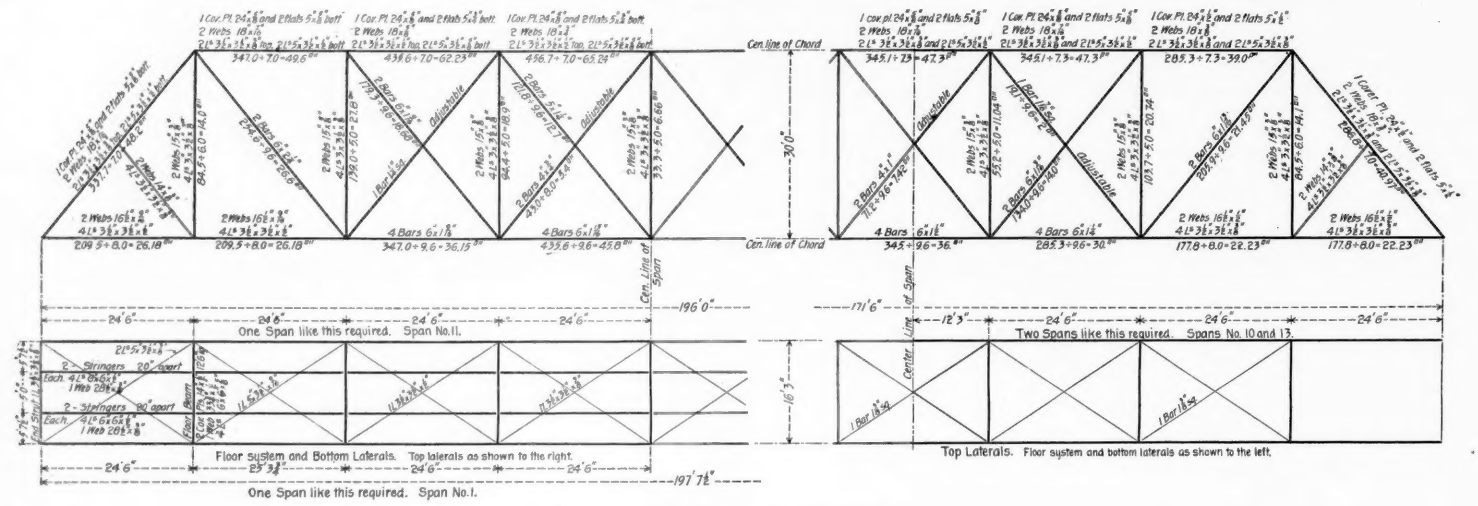


Fig. 2.—Strain Sheet, Clinton Bridge.

The assumed loading per lineal foot of track was as follows:

		Live load, lbs.	Dead load, lbs.
Floor system. ..	Stringers..........	9,600	500
	Floor beams......	5,610	500
Trusses..........	196-ft. span........	.....	2,450
	171-ft "	. .	2,160

Floorbeam reaction .... 84,500 lbs.
Stringer " .... 30,950 lbs.

The unit stresses, in lbs. per sq. in., used in calculating the cross-section of the various members, were as follows:

		Live load.	Dead load.
Plates and shapes..........................		8,000	16,000
Eyebars..		9,600	19,200
		Shear.	Bearing.
Rivets. In floor system..	Shop..........	6,000	12,000
	Field..........	5,100	10,200
In trusses.......	Shop.....	7,500	15,000
	Field..........	6,000	12,000
Pins..		6,000	12,000

Owing to the danger from the breaking up of ice and other uncertainties connected with the erection of a bridge on falsework in the Mississippi River, especial care was taken in designing the falsework to permit of rapid progress after the old iron spans were removed. The falsework is shown in detail by Fig. 3, and it will be noted that it consisted of framed trestles resting on piles. Each bent under the new iron truss spans was accurately spaced, as shown by Fig. 1, so as to be not less than 18 in. to one side of the panel points. After the old iron work had been removed, the track was carried on stringers by the falsework. In erecting the new spans, the floor was put in, a panel at a time, by removing the blocking and temporary floor, and the old stringers and their

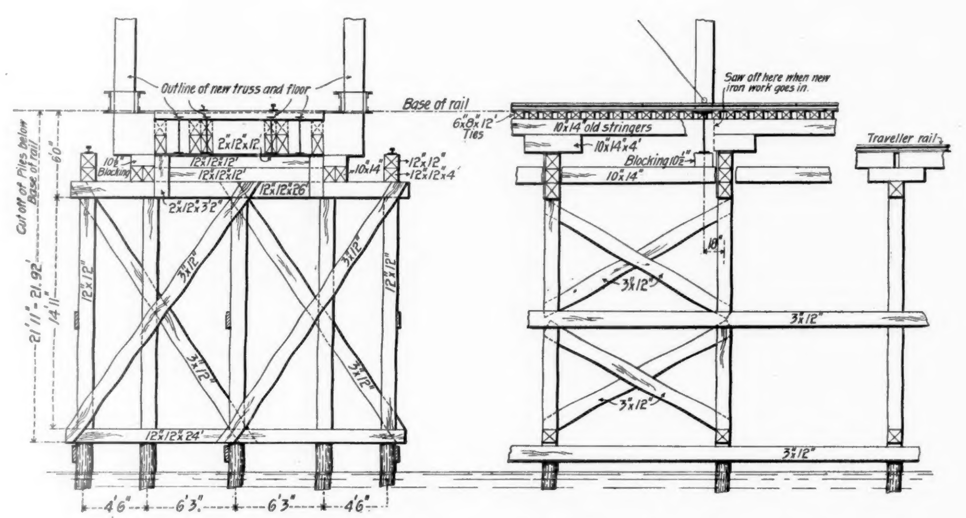


Fig. 3.—Details of False Work; Clinton Bridge.

Figs. 4 and 5 are views of span No. 1. Fig. 4 shows the progress of the work on February 24, when the new floor was resting on the falsework; the lower panel chords and intermediate posts were in position, while the center panel top chord was just being placed. Fig. 5 shows the same span, on February 26, completed and ready for the removal of the falsework. This view also gives a good idea of the appearance of the truss.

Statement Showing Renewal of Four Spans of the Mississippi River Bridge, Chicago & Northwestern Ry., at Clinton, Iowa.

Span No.	Date.	Taking down old iron.	Erecting new iron.	Remarks.
13	Jan. 19, 1898	6 panels at east and 2 at west ends		Stringer seats at east end in place.
	20	All iron down at noon		Truss seats east end and stringer seats west end.
	21		All floor beams in and all stringers except west panel	Masonry complete.
	22		Floor sytem in. 10 intermediate posts up. 2 panels west end bottom chord and center panel top chord, with laterals, counters and struts.	
	23		All iron west of center panel in place	
	24		All iron except center bottom chord bars in place	
	25		Span coupled at noon	
10	Jan. 31, 1898	All iron remov'd except 4 west pan'ls		Stringer seats at east end set.
	Feb. 1	All iron removed	East panel floor system in place	Masonry east end complete
	2		All stringers in place, except two west panels	Masonry west end half completed.
	3		Floor system in at noon, 10 intermediate posts, 2 panels bottom chord at east end in place.	Masonry complete.
	4		All iron east of center panel in place, 2 panels bottom chord at each end and top chord all up.	
	5		All iron in place except pins and center panel bottom chord	
	6		Span coupled at noon	
11	Feb. 7 1898	West end posts taken down		
	8	All iron remov'd except 5 east pan'ls		All masonry in place.
	9	All iron removed	3 panels floor system at west end in place	
	10		Floor system in. 5 intermediate posts, 4 panels bottom chord in place.	
	11		All iron west of double center panels in place	Worked 15 hours.
	12		All iron in place, last pin driven at 3 p. m	
1	Feb. 18, 1898	4 east panels iron removed		Feb 19 and 20 storm, no work.
	21	All iron down except 2 panels		Masonry at east end complete.
	22	All iron removed	3 panels floor system in place	Masonry complete.
	23		Floor system in. 6 intermediate posts all up, 4 end panels bottom chord in	
	24		4 panels iron complete, intermediate posts all up	
	25		All iron in place except 4 panels bottom chord bars	
	26		Last pin driven at 3 p. m	

Summary.

Span No.	Old span.		New spans.		Time taking down old spans.	Time erecting new spans.	Remarks.
	Length.	No. panels.	Length.	No. panels.			
13	171 ft. 0⅜ in.	13	171 ft. 6 in.	7	14 hours.	45 hours.	
10	171 ft. 0⅜ in.	13	171 ft. 6 in.	7	15 hours.	46 hours.	
11	195 ft. 7¼ in.	15	196 ft.	8	25 hours.	37 hours.	
1	197 ft. 7⅛ in.	12	197 ft. 7½ in.	8	25 hours.	47 hours.	

Average time taking out 4 panels of old floor and putting in 2 panels of new floor, 1 hour and 30 minutes. Average time taking out 2 panels of old floor and putting in 1 panel of new floor, 50 min.

A Terminal Scheme for Detroit.

We have the following official information of the plan for a terminal railroad at Detroit:

The Merchants & Manufacturers' Railroad Company is a corporation now in process of organization for the purpose of building a terminal railroad and tunnel through the City of Detroit, for the use of the Wabash, Grand Trunk, Lake Shore, Michigan Central, Canadian Pacific, Flint & Pere Marquette, Detroit, Grand Rapids & Western, and the Detroit & Lima Northern railroads.

The tunnel will be double track, and approximately one mile long under Fort and Randolph streets, connecting the Union and Brush Street passenger depots; thus facilitating the direct interchange of passenger and freight trains between the Wabash Chicago and St. Louis divisions of the Wabash, with its recently acquired Buffalo division over the Grand Trunk tracks, and affording the Grand Trunk and Lake Shore roads an entrance into the Union Depot, which is now used by all the roads except themselves and the Michigan Central. The tunnel will be entered at one end by an incline from the Union Depot viaduct, leading from the west side of the city, and at the other end will be entered at grade from the surface road.

The surface road will be approximately three miles of single track main line, with branches and spurs, located along the Detroit River frontage of the city, and affording joint terminal freight facilities and connections to industries and docks in this valuable commercial district. At some one or more points on the line of road it is proposed to establish freight warehouses ample in capacity for the joint use of all roads. This will give more especially the Wabash, Canadian Pacific and Detroit & Lima Northern roads terminals in the heart of the business district.

The plan of operation contemplated is similar to that of recent terminal properties in St. Louis and other places, in which the facilities are for the use of all roads, with a single operating department, in charge of detail movements.

All the details of the enterprise are, at present, in the formation stage, and more definite progress is awaiting terms and conditions to be agreed upon between the projectors and the Common Council of the city. The incorporators are: George H. Barbour, Robert Henkel, Frank W. Eddy, Edwin E. Armstrong, John B. Howarth, M. W. Beecher, J. B. Book, Homer Warren, Albert Pack, Fred T. Moran and James Inglis, with Thomas S. Jerome as Counsel. The Engineer-in-Chief, who planned the road, is Lewis Warfield of 54 Wall street, New York City.

A Gas Explosion in a Tunnel.

A terrific explosion of natural gas took place near the heading in the new water-works tunnel under the lake at Cleveland, Ohio, at noon May 11. Eight men had been at work and had sat down to eat their dinners, when one of them, Daniel Maher, noticed that one of the incandescent lights was flickering, and told James Anderson, a lad of 17, to go and get a new globe. Anderson did so, and was engaged in taking off the old globe, when there was a blinding flash and loud report. The men were thrown down and severely burned. Maher was the least injured, and succeeded in reaching the air-lock and giving the alarm. The men were all taken out, but six of them died the same evening in great agony, being scorched from head to foot; one died later, and Maher (?) is the only survivor.

The lumber used for centering in the tunnel took fire and filled the tunnel with smoke, so that workmen could not penetrate very far beyond the air-lock. At first the contractor increased the air pressure in hopes to drive forward the smoke and gases, and so clear the tunnel. But as the effect was to increase the flames, he cut off all supply of air, leaving the fire to smother for lack of oxygen. It is not desirable to flood the tunnel, as the excavation is in a fine homogeneous blue clay, nearly dry, yet moist enough to be plastic and easily worked in its natural state. If saturated the material would dissolve and fill the tunnel with mud, besides wrecking the green masonry lining and making future progress very difficult.

No estimate of the damage done to the tunnel has yet been made. The tunnel has been driven 6,500 feet from the shore end. Another section is worked from a shaft sunk through a crib in the lake, and another crib, so called—in fact, a circular steel cassion—is now being put in position in the lake still further from shore.

A local newspaper of the 15th says:

"Workmen yesterday succeeded in reaching the scene of the explosion. The explosion had set fire to the woodwork in the tunnel, but the fire was finally extinguished by smothering the flames.

"It was found that for a distance of seventeen feet the brickwork had been destroyed and a large quantity of clay and sand had fallen into the excavation. Considerable water had leaked through from the bed of the lake, but this will make no serious impediment."

Atmospheric Resistance to the Motion of Railroad Trains.

By Prof. W. F. M. Goss.

The resistance which must be overcome by a moving train arises from several causes; as, for example, from the rolling friction of wheel on rail, the effect of gradients and curvatures in the track, the necessity of producing accelerations in the speed, the friction of journals, and from the resistance of the atmosphere.

The work which must be done to overcome the effect of grades and to produce accelerations in speed can be accurately determined, and the value of journal and rolling friction, when considered apart from complicating conditions, is already somewhat definitely known, but the available evidence concerning atmospheric resistance is contradictory and the result of its application uncertain. The importance, therefore, of this latter element is emphasized by the fact that it is at present the chief element of uncertainty entering into any general consideration of train resistance. It is with this element only that the present discussion is concerned.

The conditions under which the experiments were made were assumed to be similar to those surrounding a train moving through still air, and the object of the experiments has been to disclose the value of forces resulting from the resistance offered by a quiescent atmosphere to the forward movement of trains through it. No attempt has been made to consider the effects resulting from oblique or other winds.

The plan of the experiments involved a rectangular conduit, within which a current of air having any desired velocity could be maintained. Within this conduit, and exposed to the action of the air currents, small dummy or model cars were mounted. Each model was connected by means of a sensitive dynamometer, with a suitable base so arranged as to indicate the value of any force tending to displace it in the direction of its length. A single model or any number of models placed in order, as in a train, could be employed in any given experiment, the effect of the wind upon each car being always shown by the indication of its attached dynamometer. It is evident that as a matter of principle it is not material whether the model is at rest and the air is moved past it, or the air still and the model moved through it; that is, if the velocity of movement is the same in each case, the value of the reaction between the wind and model will be the same.

Conduit.—The conduit in which the flow of air was maintained for the experiments, is in the form of a rectangular tube 20 in. x 20 in. in section and 60 ft. in length. A cross-section is shown by Fig. 1. The lower face is of solid wood; the upper, also of wood, is pierced at intervals of 6 ft. by good-sized openings, through which one may reach into the interior. These openings are closed by tight-fitting covers. The side faces of the conduit consist of large panels of glass set in wooden frames. The glass sides expose to view the whole interior of the conduit, so that both the position of the model cars and the reading of their dynamometers can readily be seen by the observer on the outside. The conduit is practically air tight, the joints between glass and wood being covered with glued strips of paper. The interior surfaces also are unbroken from end to end, and, where of wood, are made so smooth by shellac as to offer but slight resistance to the passage of air through the tube.

Air Supply.—The conduit is connected at one end with a No. 60 Sturtevant blower, the opposite end being open to the laboratory. The whole apparatus being in one room, the duty of the blower is simply that of circulating the air of the room through the tube, forcing it in at one end and allowing it to discharge at the other. The blower is of sufficient power to produce air currents in the conduit having a velocity of 100 miles an hour.

The Determination of the Velocity of the Air Currents.—The velocity of the moving air within the conduit was determined by use of instruments in the form of Pitot's tubes. These were made up of two brass tubes, arranged within a larger tube or jacket, all being cemented together by resin, which filled the interior of the jacket around the smaller tubes. The interior diameter of the small tubes was a sixteenth of an inch, and the diameter of the jacket tube somewhat less than a half-inch, while the length of the combination was such as would reach from the exterior to any portion of the interior of the conduit. This portion of the apparatus is shown by Fig. 2. When in use, the tip end, a, of the gage was inserted into the current through holes bored in the top planking, a cork bushing lining the hole, and making tight the joint between the wood and the gage. Each of the two small brass tubes making up a gage was then connected by rubber tubing with one side of a glass U-tube fixed to a suitable scale outside of the conduit. In the present experiments water was used in the U-tubes, and the relation between the density of water and air is such as to make a column of water one inch high the equivalent of a column of air 68.37 ft. high. The equation therefore becomes

$$v^2 = 2gh = (2 \times 32.2 \times 68.37)\ h = 4403\ h.$$

where v is the velocity in feet per second and h is the head in inches of water. If, therefore, the U-tube of a gage used in the experiment showed a displacement of an inch and a half, the velocity of the air passing the tips of gage in feet per second was assumed to be

$$v = \sqrt{4403 \times 1.5} = 81.2$$

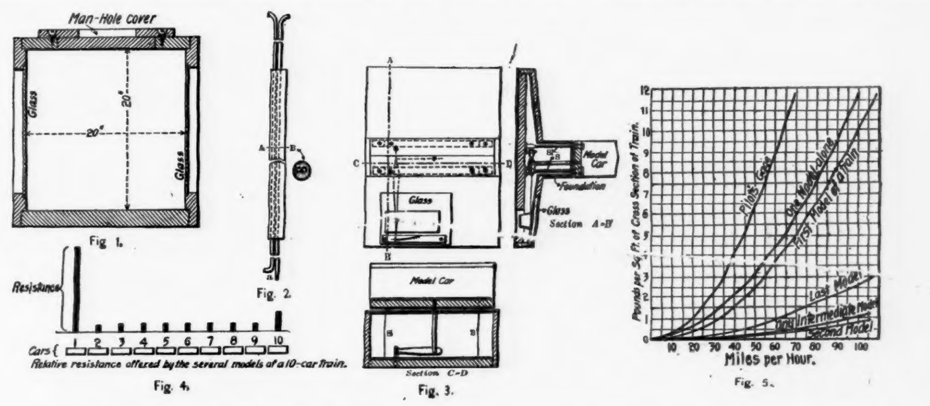
The several gages employed were subjected to a careful examination, involving a series of simultaneous observations in connection with a systematic interchange of position, to determine whether all could be depended upon to give like indications when the conditions were the same.

That there might be no uncertainty, also, as to the character of the flowing current of air, the cross-section of the stream was carefully examined at many points throughout the length of the conduit, and as a result the following conclusions were reached:

1. That, while considerable unevenness of flow was observed near the initial end of the conduit, the eddies disappeared at a distance of 35 ft. from the initial end, and from this point to a point near the discharge end of the conduit, the flow was found to follow lines which were approximately straight.
2. That the glass surfaces forming the sides of the conduit offered less resistance to the movement of the air than the wooden surfaces forming the top and bottom.
3. That the lowest velocities were found, as would be expected, in the corners of the conduit, that is, where the sides joined with the top and bottom.
4. That there was a comparatively large vein in the interior of the stream, all portions of which flowed with practically the same velocity.

The experiments which are to be described made use of that portion of the stream which was most free from eddies and which was least influenced by the walls of the conduit.

The Model Cars.—Having obtained means for making a breeze of satisfactory quality, and for determining its velocity, the next and last step concerned the model cars which were to be exposed to its influence. To facilitate the description, these model cars will hereafter be referred to as models. These were $\frac{1}{32}$ the size of an assumed standard box car the body of the model extending downward and occupying the space which in an actual car intervenes between the sills and the rails. Each model was $12\frac{1}{8}$ in long, $3\frac{5}{8}$ in. wide and $4\frac{1}{2}$ in. high, with a cross-sectional area of 14 sq. in. Its form may be more perfectly apprehended by reference to the drawing (Fig. 3). The painted tin body of the model was fitted over a wooden base supported by four legpieces of light hard-rolled sheet brass (S), which in turn were securely fastened to a suitable foundation. The length and lightness of these legs or springs allowed the car to be displaced longitudinally, under the action of the slightest force, and they were at the same time so proportioned as to resist all tendency to motion in other directions. Between the body of the car and its foundation, also, and entirely independent of the springs already referred to, was a



Goss on Air Resistance to the Movement of Trains.

*From a paper read at the April meeting of the Western Railway Club.

system of levers, the purpose of which was to multiply any longitudinal displacement to which the model might be subject. These levers were made of thin metal, the several parts being soldered to each other. All motion, consequently, was within the elastic limit of the parts affected. There were no loose joints. The whole arrangement proved to be both sensitive and reliable. The least pressure upon the car would result in a movement of the pointer, and the pointer would promptly return to its zero when the force producing the displacement had ceased to act. Excessive vibrations of the pointer were prevented by a vertical fin which could be made to dip into light oil contained in a suitable pan beneath. That no part of the dynamometer might be directly affected by the currents of air acting upon the model, the mechanism was entirely inclosed in the foundation, a portion of the surface of which was of glass through which the movement of the pointer could be observed.

Observations.—With the desired number of models arranged as a train, which alone was used in determining velocities in the conduit, the experiments proceeded about as follows: The blower engine was started and allowed to run at a slow speed for a sufficient time to secure constancy of conditions with the conduit, after which readings were taken simultaneously from the gage A, and the dynamometers of the several cars composing the train. These observations were repeated at thirty-second intervals until five readings had been taken, when the averages of the five successive readings were brought forward to a condensed log of observation. When one set of readings had been taken the speed of the blower was increased, and all observations made for the new conditions. In this manner the work was advanced with each length of train, the velocities of the air currents varying from 20 miles per hour to something over 100 miles per hour. No effort was made to obtain definite conditions of air velocity, the object being to have a constant flow, and to observe accurately what were the precise values by which the conditions were defined. The work extended through several weeks, but the care taken throughout its progress was such that the data are remarkably consistent, as shown by tables I. to VI.:

Table I.—One Model.

Number of test.	Gage displacement, inches of water.	Pressure equivalent of gage displacement, pounds per square ft.	Pressure by gage multiplied by area of cross-section of model in square ft.	Actual force tending to displace model, as shown by model dynamometer, in pounds.	Ratio of force tending to displace model (Col. IV) to pressure due to velocity (Col. III).	Velocity calculated from reading of gage. Feet per second.	Miles per hour.
	I	II	III	IV	V	VI	VII
1	0.3	1.6	.15	.094	.61	36	25
2	0.8	4.2	.40	.219	.54	60	41
3	2.6	13.5	1.31	.625	.48	107	73
4	3.8	19.7	1.91	.906	.47	130	88
5	5.0	26.0	2.52	1.254	.49	149	102

One Model.—The effect of a current of air, impinging directly upon the end of a single model may be assumed to represent the sum of three partial effects: (1) the effect of the direct action due to the exposure of the initial end of the model; (2) the effect of frictional action along the sides and top of the model,' and (3) the effect of diminished pressure or "suction" at the rear of the model.

It is significant that the numerical value of the sum of these effects upon the model is much less than the calculated value based upon the cross-section of the model, and the indications of the pressure gage.

A review of all the figures presented in this table will show that in every case the force tending to displace the model is less than that found by multiplying the calculated wind pressure of unit area by the area of the cross-section of the model. The value of the ratio, while nearly constant, tends to become less as the velocities of the air currents are increased. The error would not be great if the ratio of the actual force to the calculated force were assumed to be always 0.55.

It cannot but seem strange at first that the direct pressure on the front of the model, the friction of the wind along its sides and top, and the suction at its rear, taken altogether, should actually be of less value than that which results from the impinging stream of air on the point of the gage. But the fact is well established.

Two Models.—When two models are arranged in a train, the first is affected by the direct force of the wind, while the second is affected by the suction of the passing stream, and both are influenced by the frictional effects of the wind upon sides and top. The result of experiments upon two models are given in Table II., in which, under columns IV. and V., the effects upon the separate models, and upon both models taken together will be found given.

In reviewing the first experiment as presented in this table, it will be seen that, while the calculated pressure acting upon an area equal to that of the

Table II—Two Models.

Number of test.	Gage displacement, inches of water.	Pressure equivalent of gage displacement, pounds per square foot.	Pressure by gage multiplied by area of cross section of model in square ft.	Actual force tending to displace model, as shown by model dynamometer, in pounds. IV First model.	Second model.	Both models.	Ratio of force tending to displace models (Col. IV) to pressure due to velocity (Col. III). V First model.	Second model.	Both models.	Velocity calculated from reading of gage. Feet per second. VI	Miles per hour. VII
	I	II	III								
1	0.3	1.6	.15	.047	.031	.078	.31	.21	.52	36	25
2	1.0	5.2	.50	.200	.078	.278	.40	.15	.55	66	45
3	2.1	10.9	1.06	.438	.150	.588	.41	.14	.55	96	66
4	2.8	14.6	1.42	.563	.172	.735	.40	.12	.52	111	76
5	5.4	28.0	2.72	1.094	.328	1.422	.40	.12	.52	154	105

Table III—Three Models.

Number of test.	Gage displacement, inches of water.	Pressure equivalent of gage displacement, pounds per square foot.	Pressure by gage multiplied by area of cross section of model in square ft.	Actual forces tending to displace model, as shown by model dynamometer, in pounds. IV First model.	Second model.	Third model.	Three models.	Ratio of force tending to displace model (Col. IV) to pressure due to velocity (Col. III). V First model.	Second model.	Third model.	Three models.	Velocity calculated from reading of gage. Feet per second. VI	Miles per hour. VII
	I	II	III										
1	.65	3.4	.33	.125	.031	.056	.212	.38	.09	.17	.64	51	37
2	1.6	8.3	.81	.325	.017	.109	.451	.40	.02	13	.53	84	57
3	2.5	13.0	1.26	.500	.063	.163	.726	.40	.05	.13	.58	105	72
4	4.2	21.8	2.11	.844	.109	.259	1.203	.40	.05	.12	.57	136	93
5	5.6	29.1	2.82	1.125	125	328	1.578	.40	.04	.12	.56	157	107

Table IV—Five Models.

Number of test.	Gage displacement, inches of water.	Pressure equivalent of gage displacement, pounds per square foot.	Pressure by gage multiplied by area of cross section of model in square ft.	Actual forces tending to displace model, as shown by model dynamometer, in pounds. IV First model.	Second model.	Third model.	Fourth model.	Fifth model.	Five models	Ratio of force tending to displace model (Col. IV) to pressure due to velocity (Col. III). V First model.	Second model.	Third model.	Fourth model.	Fifth model.	Five models	Velocity calculated from reading of gage. Feet per second. VI	Miles per hour. VII
	I	II	III														
1	1.25	6 5	.63	.234	.016	.028	.025	.094	**.397**	.37	.025	.044	.039	.15	**.63**	74	51
2	2.3	12 0	1.16	.469	.031	.047	.041	.156	**.744**	.40	.026	.040	.035	.13	**.63**	101	69
3	3 9	20.2	1 93	.750	.059	.069	.069	.219	**1.166**	.38	.030	.035	.035	.11	**.59**	131	89
4	4.8	24.9	2.42	.938	.075	.100	.094	.275	**1.482**	.39	.031	.041	.038	.11	**.61**	145	99
5	5.4	28.0	2.72	1 063	.088	.109	.106	.297	**1.663**	.39	.032	.039	.039	.11	**.61**	154	105

Table V—Ten Models.

Columns IV: Actual force tending to displace model, as shown by model dynamometer, in pounds.

Number of test.	Gage displacement, inches of water. I	Pressure equivalent of gage displacement, pounds per square foot. II	Pressure by gage multiplied by area of cross section of model in square ft. III	IV First model.	Second model.	Third model.	Fourth model.	Fifth model.	Sixth model.	Seventh model.	Eighth model.	Ninth model.	Tenth model.	Ten models.
1	.5	2.6	.25	.094	.006	.008	.009	.009	.009	.009	.009	.009	.022	.184
2	.65	3.4	.33	.131	.009	.017	.016	.015	.015	.015	.015	.016	.034	.283
3	.9	4.7	.45	.175	.013	.016	.017	.017	.016	.016	.018	.016	.044	.348
4	1.1	5.7	.55	.219	.016	.022	.021	.019	.020	.021	.021	.020	.056	.435
5	1.5	7.8	.76	.313	.021	.033	.034	.035	.035	.034	.036	.034	.088	.663
6	2.0	10.4	1.01	.406	.029	.038	.038	.040	.038	.039	.040	.039	.103	.810
7	2.25	11.7	1.13	.469	.031	.047	.045	.046	.046	.046	.047	.047	.115	.939
8	3.35	17.4	1.69	.656	.048	.060	.060	.062	.062	.062	.061	.063	.163	1.297
9	3.8	19.7	1.91	.750	.061	.075	.075	.075	.075	.075	.075	.075	.181	1.517
10	4.1	21.3	2.07	.813	.069	.0·1	.079	.081	.080	.080	.081	.081	.200	1.645
11	4.4	22.8	2.21	.875	.072	.088	.090	.088	.089	.088	.090	.089	.213	1.782
12	4.8	24.9	2.42	.938	.075	094	.094	.094	.094	.094	.094	.093	.244	1.914
13	5.2	27.0	2.62	1.031	.081	.098	.097	.097	.098	.098	.097	.098	.256	2 051
14	5.4	28.1	2.73	1.125	.088	.109	.110	.110	.111	.111	.111	.110	.265	2.250

Columns V: Ratio of forces tending to displace model (Col. IV) to pressure due to velocity Col III). Columns VI–VII: Velocity calculated from reading of gage.

Number of test.	V First model.	Second model.	Third model.	Fourth model	Fifth model.	Sixth model.	Seventh model.	Eighth model.	Ninth model.	Tenth model.	Ten models.	Feet per second. VI	Miles per hour. VII
1	.42	.027	.035	.040	.040	.040	.040	.040	.040	.098	.82	47	32
2	.40	.027	051	049	.045	.045	045	.045	.049	.103	.86	54	37
3	.38	.029	.035	.037	.037	.035	.035	.039	.035	.097	.76	63	43
4	.34	.024	.034	032	.029	.030	.032	.032	.030	.086	.67	70	48
5	.41	.028	.043	.045	.046	.046	.045	.047	.045	.116	.87	81	55
6	.40	.029	.038	.038	.040	.038	.039	.040	.039	.103	.80	94	64
7	.41	.027	.041	.039	.040	.040	.040	.041	.041	.101	.82	100	68
8	.38	.028	.035	.035	.036	.036	.036	.036	.137	.095	.75	121	83
9	.38	.032	.039	.039	.039	.039	.039	.039	.039	.094	.78	129	88
10	.39	.033	039	.038	.039	.038	.038	.039	.039	.097	.79	134	91
11	.39	.032	.039	.041	.039	.040	.039	.041	.040	.096	.80	139	95
12	.39	.031	.039	.039	.039	.039	.039	.039	.038	.101	.79	145	99
13	.39	.031	.038	.037	.037	.038	.038	.037	.038	.097	.75	151	103
14	.41	.032	.040	.040	.040	.041	.041	.041	.040	.097	.82	154	105

Table VI—Twenty-five Models.

Columns IV: Actual force tending to displace model, as shown by model dynamometer, in pounds.

Number of test.	Gage displacement, inches of water. I	Pressure equivalent of gage displacement, pounds per square foot. II	Pressure by gage multiplied by area of cross section of model in square ft. III	IV First model.	Second model.	Third model.	Ninth model.	Fifteenth model.	Nineteenth model.	Twentieth model.	Twenty-fifth model.	All twenty-five models.
1	2.1	10.9	1.06	.422	.031	.047	.041	.044	.041	.044	.109	1.503
2	2.5	13.0	1.26	.500	.041	.056	.050	.050	.050	.050	.125	1.772
3	3.0	15.6	1.51	.594	.047	.059	.056	.053	.059	.059	.156	2.041
4	3.6	18.7	1.81	.719	.056	.069	.069	.063	.069	075	.184	2.471
5	4.1	21.3	2.07	.812	.063	.081	.088	.081	.075	.0·1	.213	2.888
6	4.3	22.3	2.16	.875	....	.088	.088	.088	.088	088	219	
7	4.8	24.9	2.42	.938	....	.094	.094	.094	.094	.094	.244	
8	5.1	26.5	2.57	1.000	....	.100	.100	.100	.100	.100	.263	

Columns V: Ratio of forces tending to displace model (Col. IV) to pressure due to velocity (Col. III). Columns VI–VII: Velocity calculated from reading of gage.

Number of test.	V First model.	Second model.	Third model.	Ninth model.	Fifteenth model.	Nineteenth model.	Twentieth model.	Twenty-fifth model.	All twenty-five models.	Feet per second. VI	Miles per hour. VII
1	.39	.029	.044	.038	.041	.038	.041	.102	1.40	96	66
2	.39	.032	.044	.039	.039	.039	.039	.099	1.38	105	72
3	.39	.031	.039	.037	.035	.039	.039	.103	1.47	115	78
4	.39	.031	.038	.038	.034	.038	.041	.102	1.35	126	86
5	.39	.030	.039	.042	.039	.036	.039	.103	1.39	134	92
6	.40	....	.041	.041	.041	.041	.041	.101		138	94
7	.39	....	.038	.038	.039	.039	.039	.101		145	98
8	.39	..	.039	.039	.039	.039	.039	.102		150	102

cross-section of the train is .15 pounds, the sum of the readings of the dynamometer for both models shows but .078 pounds, or 52 per cent. of the calculated amount. This is but a trifle more than was found for a single model. An examination of the table will show also that the dynamometer readings of the first model were less than those observed when a single model was exposed to the influence of the air currents (Table I.). This result is due to the fact that the second model removed from the first, the effect of the suction influences. The results show that the force acting upon the first model was about .40 of the calculated force; that acting upon the second model, about .14 the calculated force; and that acting upon the two models together, about .54 of the amount calculated, which values are to be compared with the .50 shown for one model. Doubling the length of the train resulted in this case in an increase of force in the ratio approximately of .50 and .54, that is in an increase of about 8 per cent.

The First Model of a Train.—In all of these cases it will be seen that the forces acting upon the first model are practically the same whenever the velocity of the current is the same; the conclusion, therefore, seems to be justified that whenever a train is composed of more than two models the resistance of the first model is a function of the velocity of the air current only. This statement is, perhaps, not absolutely true, but is practically so. Again, the value of the force is, approximately, .4 of the calculated force based upon the pressure equivalent of the velocity of the wind as disclosed by gage, and an area equal to that of the cross-section of the model.

The Last Model of a Train.—The forces to be resisted by the last model become less as one length of the train is increased, a condition doubtless due to the fact that the enveloping layers of air immediately about the train, and which are retarded by frictional contact with it, become thicker and thicker in passing from the front to rear, with the result that in a long train the currents immediately about the last model are less active than when the train is shorter, and as a consequence the suction effect is reduced. The data show that with the two-model train, the rear model resists a force which is 14 per cent. of the calculated pressure, based upon the velocity of the current and the area of the cross-section of the train; with the three-model train it is 13 per cent.; with the five-model train it is 12 per cent.; with trains of ten models in length it is less than 10 per cent.; but with a train of twenty-five models it is still about 10 per cent.

The Second Model of a Train.—In all experiments when more than two models composed the train, the forces acting upon the second model of a train appear to have been less than those acting upon any other model of the train. This is explained on the assumption that the currents in passing the first model are so deflected that some of the wave lines pass around the second model, thus relieving it of a portion of the force to which it would otherwise be subjected.

Models Between the Second and the Last of a Train.—Whatever the length of the train, all intermediate models, the second excepted, seem to have been met by an equal force regardless of their location in the train. Thus, with a ten-model train, and a wind velocity of 64 miles per hour, the observed force in pounds acting upon the several models from the third to the ninth, inclusive, was .038, .038, .040, .038, .039, .040, 0 39, respectively. For all experiment the percentage of the calculated pressure based upon wind velocity and cross-section of the train, which appears as a force acting upon intermediate cars, is shown to be between 3.8 per cent. and 4 per cent. This, of course, is the sum of frictional action along sides and top, and such effect as may arise from eddies between the models.

Distribution of Forces Acting Throughout the Length of the Model Train.—The preceding paragraphs show that each portion of a train of models presents a resistance to the currents of air moving past it, which is a fixed percentage of the pressure equivalent of the velocity of the current; or, to make the statement more concise, the resistance offered by each portion of the train is a constant function of the velocity of the current. This relationship is shown graphically for a train of ten models by Fig. 4. It holds good for all velocities.

Relation of Force and Velocity.—The relation between the velocity of the current and the resulting forces acting upon each model of a train may be shown by plotting the dynamometer readings (column IV.) for each of the several models with the velocities (column VII.) corresponding. From a smooth curve drawn through the points thus obtained, equations may be written to represent the velocity as follows:

For a single model alone:

$a_1 = .000116\ V^2$ ....(1)

For the first model of a train:

$a_f = .000097\ V^2$ ....(2)

For the last model of a train:

$a_l = .000025\ V^2$ ....(3)

For the second model of a train:

$a_s = .000008\ V^2$ ....(4)

For any intermediate model of a train:

$a_i = .000010\ V^2$ ....(5)

In the preceding equations a is force in pounds acting upon the model in the direction of its length, and V is velocity of the air current in miles per hour. In the form in which they are given, the equations are not of general value, since they are based on the dimensions of the particular models employed in the experiments.

Equations of a more general character may, however, be readily obtained by reducing the observed forces acting upon each model, to equivalent forces which would have been observed had the area of the cross-section of the models been one square foot, the proportions of the models remaining unchanged. Thus, the area of the cross-section of the actual models was .097 sq. ft. By dividing the observed dynamometer readings by this factor, and by plotting results with corresponding velocities, the curves shown in Fig. 5 are obtained. When P is the pressure in pounds per square foot and V the velocity of the air currents in miles per hour, the following equations representing the curves may be written:

For the Pitot gage:

$$P = .0025V^2$$

For one model alone:

$$P_1 = .0012V^2$$

For the first model of a train:

$$P_f = .001V^2$$

For the last model of a train:

$$P_l = .00026V^2$$

For the second model of a train:

$$P_s = .00008V^2$$

For any intermediate model between the second and the last of a train:

$$P_i = .0001V^2$$

A Summary of Conclusions to be drawn from the work with models may be stated as follows: When a model having the proportions of a standard freight car, or when a train of such models is submerged in currents of air, the length of the model or train being extended in the direction of the current, effects are observed which, briefly stated, are as follows:

1. The force with which the current will act upon each element of the train, or upon the train as a whole, increases as the square of velocity.

2. The effect upon a single model, standing alone, measured in terms of pressure per unit area of cross-section, is approximately .5 the pressure per unit area as disclosed by the indications of the Pitot gage.

3. The effect upon the different models composing a train varies with different positions in the train; it is most pronounced upon the first model; next in order of magnitude is its effect upon the last model; next, its effect upon each intermediate models other than the second; and, last of all, is its effect upon the second model.

4. The relative effect upon different portions of a train is approximately the same for all velocities; for example, any intermediate model other than the second always has a force to resist which is, approximately, one-tenth that resisted by the first model, while the last model has a force to resist which is one-quarter that resisted by the first.

5. The ratio of the effect upon each of the several models composing a train, measured in pressure per unit area of cross-section, compared with the pressure per unit area disclosed by the indications of the Pitot gage, is, approximately, for the first model of the train, 0.4; for the last model of the train, 0.1; for any intermediate model between the second and last, 0.04; and for the second model, 0.032.

Atmospheric Resistance to Actual Trains.—Thus far attention has been directed to the effects produced by currents of air acting upon fixed models similar to freight cars in outline and proportions, but much less in size. It is fair to presume that had the models been larger than those which were really employed, the results observed would have been entirely consistent with those already given. If their dimensions had equaled those of a full-sized car even, there is no reason for supposing that the results obtained would have been disproportional to those which were actually observed from the smaller model, and it may be assumed, therefore, that the effects which would manifest themselves on a full-sized car of the same proportions with the model, may be predicted with approximate accuracy from the known effects produced upon the model.

A full-sized car having the same proportions with the models used in the experiments, would be a plain structure 33 feet long and 9 feet wide, rising from a point close to the ground to a height of 12 feet along the center and 11 feet along the sides. When such cars are arranged in trains, clear spaces of three feet would intervene between them. This combination of cars might be considered as representing for the present purpose an ideal train. The characteristics of an actual train, however, are difficult to define. Cars vary in the dimensions of their cross-section, in their length, and in the contour of their sides and roof. Box cars are of simpler outline than coaches, and vestibuled trains present a more uniform cross-section than platformed cars. Trains may be made up of cars of uniform size, or of cars, each one of which may be so different in its proportions or outline, as to produce an effect upon the atmosphere through which it moves, measurably different from that produced by any other car of its train.

A careful review of the subject will show that differences in form or proportions existing between the model and the actual cars may not be greater than those existing between two different types of actual cars. The difference in effect arising from these differences in form and proportion, therefore, may be no greater in the former case than in the latter. If this is true the models will serve as a good basis from which to make comparisons, and the belief is that the results which are given in succeeding paragraphs are not only sufficiently accurate for every practical purpose, but that they are as nearly true as any general statement applying to all conditions of service can be.

Before proceeding to a consideration of details, it will be well to observe that estimates which have hitherto been calculated concerning the value of the resistance offered by the atmosphere to the progress of railroad trains, have been generally made upon a tonnage basis. An explanation for this is doubtless to be found in the lack of knowledge regarding atmospheric action. As the other resistances to which a train is subject are well expressed upon a tonnage basis, it has been convenient to express that which is of uncertain value in the terms of those facts which are better known. There is no justification for such a practice, for it is obvious that the atmospheric resistance for a loaded car is no greater than for a light car, values in either case depending entirely upon the size, proportions and contour of the car.

Application of Results Obtained From Models.—As the models experimented with were $\frac{1}{32}$ the size of a typical full-sized car, which, for the present purpose, may be assumed to represent any 33-ft. box car, the area of each surface presented in the actual car is $(32)^2 = 1024$ times the area of similar surfaces in the model. It is assumed that the effect of the wind upon solids of the same proportion will vary with the extent of exposed surface, so that the atmospheric resistance which will oppose the progress of the actual car will be to that which would oppose the progress of the model as 1024 is to 1. That is, if a is the force in pounds resisted by the model under the conditions of the experiments, and A the force due to atmospheric resistance to be overcome by the actual car under conditions of service, then

$A = 1024a$ ....(6)

Expressions have already been written (equation 1 to 5) giving the force in pounds resisted by models under the influence of air currents having a velocity of V miles an hour. Combining these with equation 6, gives the resistance in pounds, A, to be overcome by the actual car when moving in still air at a velocity of V miles an hour.

Thus, equation 1, expressing the resistance offered by a single model, is $a_1 = .000116V^2$..................(1) and equation 6 gives

$$a_1 = \frac{A_1}{1024}$$

Therefore, for a single actual car alone, $A_1 = .119V^2$.(7)

By a similar process there may be obtained:

For the first car of an actual train, $A_f = .099V^2$...(8)

For the last car of train, $A_l = .026V^2$...............(9)

For the second car of a train, $A_s = .008V^2$........(10)

For any intermediate car between the second and last, $A_i = .010V^2$..................................(11)

The atmospheric resistance for trains of such cars is the sum of the resistance of the several parts.

Resistance Offered to Locomotive and Tender.—In the application of the equations given above, a locomotive and tender running alone may be regarded as two cars. In a train of freight cars headed by a locomotive and tender, the locomotive should be regarded as the first car and the tender as the second. Thus, the tractive force in pounds necessary to overcome the atmospheric resistance due to the motion of a locomotive and tender running alone is equivalent to

$$A = A_f + A_l = .099V^2 + .026V^2 = .125V^2$$

which for speed of 40 miles an hour gives 200 pounds.

The tractive force necessary to overcome the resistance of a locomotive and tender running at the head of a train is equivalent to

$$A = A_f + A_l = .099V^2 + .010V^2 = .109V^2$$

which at a speed of 40 miles an hour gives 174 pounds.

Resistance Offered to Trains of Freight Cars.—A train composed of a locomotive, tender and 20 freight cars would, in effect, be equal to 22 freight-car units. The resistance to be overcome would be that of the first unit plus that of 20 intermediate units plus that of the last unit. That is

$$A = A_f + A_i b6 + A_l = .325V^2 \quad (b = 20)$$

which at a speed of 40 miles an hour gives 520 pounds.

If it is required to find the force necessary to overcome the atmospheric resistance of only that portion of the train which is behind the tender, the resistance of the first unit (in this case the locomotive) and that of the second unit (in this case the tender) must be removed from the equation, that is $A = 0$ and $b = 19$, so that the equation becomes

$$A = 0 + 19A_i + A_l = .216V^2$$

The resistance, therefore, opposing the progress of the 20 cars in a train following a locomotive and tender at a speed of 40 miles an hour, is 346 pounds.

Resistance Offered to Trains of Passenger Cars.—The atmospheric resistance of a train of passenger coaches can be determined by reducing the number of coaches to an equivalent number of freight cars.

(Continued on page 362.)

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
Published Every Friday,
At 32 Park Place, New York.

EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

The returns of railroad gross earnings for April as compiled by the Chronicle show a gain of nearly $6,000,000, or about 15 per cent., as compared with last year. This is for 100,870 miles. For the year from Jan. 1 to April 30 the gain is also about 15 per cent., or $23,958,000. Naturally, the heaviest gains have been among the roads that have a large grain traffic, not merely because of the great movement of grain, but also because of the return movement of merchandise. Furthermore, there was an increase in the movement of live stock and provisions and a continued growth in the cotton movement. The receipts of grain at the Western primary markets gained nearly 12 million bushels, reaching in the aggregate 35¼ millions. The receipts at Chicago more than doubled. Fifteen railroads showed gains in gross of upward of $100,000 each. The Northern Pacific heads the list with an increase of $566,397, but the Illinois Central gained more than half a million and the Missouri Pacific $416,000. The St. Paul, the Great Northern, the Rock Island, the Canadian Pacific and the New York Central each gained over $300,000.

Receiver S. M. Felton, of the Cincinnati, New Orleans & Texas Pacific has issued a notice that in addition to the premiums now being paid to employees in the train service he will, from July 1, 1898, and semi-annually thereafter, pay the following: To enginemen of freight trains, $40; to firemen of freight trains, $20; and to brakemen of freight trains, $20. For engineman and firemen the basis of awards will be making schedule time, freedom from accident, and especially from trains parting, promptness and accuracy in reports, cleanliness of engine and engine equipment, economical use of supplies, good judgment in emergencies and observance of the rules. For brakemen: freedom from accident, and especially from trains parting, cleanliness of caboose, economical use of supplies, good judgment in emergencies and observance of the rules. This announcement is the most significant bit of evidence concerning the value of premiums as an element in good discipline and as a means for improving the service, that we have had the privilege of publishing since 1887, when we first announced Mr. Brown's $60 premium to freight conductors. The significance of Mr. Felton's order lies in the fact that he is offering additional premiums in consequence of the satisfactory results obtained from the premium offers which he has already in force. Our readers will recall the existing scheme of premiums on this road from the descriptions published in these columns Feb. 5, 1897, and April 29, 1898. For ten years we have heard premiums commended in words, but, except in the roadway department, this is the first commendation that we can recall which has taken the shape of an expansion of the plan in practice. As long as labor organizations exist and are conducted as most of them now are, the principle of premiums ought to be attractive to every railroad superintendent; for the payment of premiums, recognizing the difference between excellent work and that which is only ordinary, is a means of meeting one of the most vicious principles of the labor organization, that which would put all the men on one level regardless of ability, pluck or thrift. It will be noted that Mr. Felton sticks to the plan of paying the premiums half-yearly. As the interest in the plan, on the part of the men, must center to a considerable extent around the settling days—as interest in work everywhere centers with more than average intensity around the pay car—this must keep up enthusiasm better than yearly payments do.

This is, we believe, the first instance of a regular premium, on this basis, to enginemen. In important respects it must be an improvement over premiums based on fuel economy alone. Coal premiums must always be small, for most of the men, and variations in the quality of the supply and in the conditions of the service, are always making trouble. Some men who from lack of skill or from unavoidable circumstances cannot save coal, may yet deserve commendation, as much as the conductor, for the general management of the train. The engineman and the fireman may not always receive their $60 in just proportions, for a good engineman will cover up the faults of a careless fireman, and vice versa; but that is a matter which, probably, no rule can provide for. The inclusion of the brakemen makes the scheme for freight trains complete. In view of the importance of the prevention of trains parting on descending grades, this is only a fair recognition of the joint responsibility of the men on all parts of the train. A freight crew on a hilly road once received a special gratuity of a month's pay for getting a broken train together on a steep grade without smashing any couplers. The train parted in two places just as it started down a long and crooked grade. The conductor being a man of decidedly more skill than the engineman, and the question of responsibility for not preventing the break-in-two at the outset having been raised, there was considerable discussion among the gossips of the round house and the caboose as to the relative deserts of the different men in the distribution of the prizes; and it appeared quite clearly that with the best conductors and the best enginemen, intelligently co-operating, and aided by efficient brakemen, break-in-twos did not occur. The conductor admitted that if he always could select his engineman and brakemen he would never receive premiums for getting trains together, for there would be no necessity of getting them apart. This illustrates the value of a premium for prevention as contrasted with one for cure.

The Baltimore & Philadelphia "Differentials."

The Interstate Commerce Commission has rendered its report on the complaint by the New York Produce Exchange that the difference between the rates to New York and those to Philadelphia and Baltimore from the West, are so great as to constitute an undue discrimination against the commerce of New York. (Railroad Gazette, May 13, page 345.) After considering the evidence concerning the ocean rate from these several ports to Europe, which are so variable that no general statement concerning them can be made, and the great mass of statistics presented concerning the receipts and exports of grain and flour at the several Atlantic and Gulf ports for a long series of years, the Commission is unable to find sufficient evidence of discrimination to warrant its interference; that is, it comes to substantially the same conclusion as did Messrs. Allen G. Thurman, Elihu B. Washburne and Thomas M. Cooley, who made a most elaborate investigation of the same question, with the invaluable assistance of the late Albert Fink, in 1882. They then, as the Interstate Commission does now, found the matter an exceedingly complicated one, affected by a number of facts that vary from year to year; they then, as the Commission does now, found important fluctuations in the movement to different ports, most of which could be fairly explained by known facts, but some of which seemed inexplicable.

The first serious struggle over this matter was in 1876. The Baltimore & Ohio had then but recently completed its line into Chicago, and it set out to build up a great export business from Baltimore, which theretofore had very little. At that time the regular rate to Baltimore was 5 cents, and recently it had been 10 cents per 100 lbs. less than to New York. In the struggle of 1876 it was supported by the Pennsylvania Railroad, which, as many do not know, sometimes carries more grain to Baltimore than the Baltimore & Ohio itself, and whose route to Baltimore is the shortest line from Chicago to the seaboard. The Pennsylvania, however, was an unwilling participant in this struggle, having in those days no profits to spare for fighting. Before that time Montreal ranked next to New York as a grain exporter, and the railroads were only beginning to carry grain through from the West to the seaboard during the season of navigation.

The "war rate" of 20 cents per 100 lbs. from Chicago to New York, which prevailed in 1876, was considered to be less than the cost; and certainly to make a difference of 5 cents in favor of Baltimore quite impossible. The result of the season's contest showed a serious loss of earnings to all the trunk-lines; and New York suffered in its exports. Philadelphia, which had never had 10 per cent. of the total Atlantic exports previously, in 1876 had 17½ per cent.; and Baltimore, whose largest proportion previously had been 12⅝ per cent., in 1876 had 19⅝ per cent.; while New York, which had 56 per cent. in 1875 and more than 60 per cent. in previous years, had but 44 per cent. in 1876. Together Philadelphia and Baltimore exported 46¾ million bushels in 1876, while their maximum theretofore had been 20¼ millions. Extremely low rail rates worked against New York, as they always do, by reducing its receipts by the route which serves it alone, the Erie Canal, on which tolls were charged at that time. But the result of the struggle was a reduction of the differences in rates. Any one desirous of investigating this chapter of ancient history may find an elaborate discussion of it from week to week in the Railroad Gazette of 1876, and especially in long articles with graphical statistics, in the numbers for Feb. 23 and March 2, 1877.

The differences in rates then made have continued substantially ever since; the New York Central protested against them and made them the ostensible occasion of a railroad war on one occasion, but probably other reasons were actually the controlling ones. The appointment of the Thurman Commission by the railroads was probably induced more to satisfy the public than to settle serious differences among the railroads. For there is now really comparatively little difference in the actual interests of the chief trunk lines. When the Pennsylvania Railroad ended at Philadelphia, and the New Jersey Railroad exacted of it a high and arbitrary rate on what it forwarded to New York, and when the Baltimore & Ohio ended at Baltimore, it was greatly to the interest of these companies that the produce of the country should be exported from Philadelphia and Baltimore. Both of these companies now have lines, and very costly ones, to New York; these lines can be supported only by traffic, and it is to the interest of both these companies that all the exports should go from New York rather than from Philadelphia and Baltimore, provided the New York rate is enough higher to cover the additional cost of hauling to New York, plus any profit, however small.

This is a consideration which is likely to be decisive with anyone who studies the complicated, fluctuating, and sometimes conflicting circumstances. Aside from this, there are three other railroads which carry grain from Lake Erie to New York, and little to any other port, and thus almost the whole trunk line system, which makes the rates, is interested in making them favorable to New York.

There are certain changes which have naturally tended to decrease New York's grain exports. The establishment of a line to Europe through Newport News, which can export through that port only, takes traffic from the ports further north. The growth of exports at New Orleans and at Galveston, due to the deepening of their outlets to the sea, also takes something from them; that was what the money was spent on them for. None of these things have been a disadvantage to New York's commerce as a whole, though they have reduced its grain trade. It is vastly better for New York that grain growing in the West should be profitable than that New Yorkers should make a profit on the grain exports, and the same is true even of the New York railroads. New York has an overwhelmingly large share of the import trade, and the other grain exporting cities have very little; and this trade depends on the growth and prosperity of the country. Grain-growing for many years until last year has been unprofitable, and manufacturers and traders all over the country have suffered from it. Certainly the railroads in the trunk line territory have done what they could to make it profitable; and now that it has become profitable they are apparently doing still more, so that of the great re-

turns from the last harvest they are having no share, except the indirect (but very important) one which comes from the effect of the farmers' prosperity on other industries.

The Air Resistance of Trains.

All that is definitely known about train resistance can be summed up in a few general statements. The formulae which have been derived from specific tests are unreliable, and have been found to be so widely in error for many conditions of service, that it is largely a matter of opinion which formula is nearest correct. A serious objection to the best known formulae is that an attempt has always been made to include in a single expression all the factors which enter into the problem. There seems, however, to be a tendency to discard many of the theories formerly accepted, and to try to obtain some general basis from which equations can be derived which will cover specific cases; it is evident that this is just the reverse of the usual methods of investigating the resistance of trains.

The total resistance of a train is made up of so many factors that it is now generally acknowledged that they cannot to advantage be studied collectively. Thus there is the effect due to grades, curves, accelerations in speed, the rolling friction of the wheel on the rail, the flange friction on straight track, journal friction and the resistance of the atmosphere. In any road test, all these enter to affect the final results, so that data obtained from service tests of necessity must apply to only a particular set of conditions, and even fairly accurate conclusions for general application cannot be drawn. Before a useful analysis can be made of the resistance of a train, each factor entering into the final result must be considered separately under such conditions that all the factors can be controlled at will. This is a problem similar to those which remained unsolved until the plan was devised for mounting a locomotive on a testing plant, and while we are not prepared to admit that the laboratory offers facilities for determining all the required information concerning train resistance, or that such results can be directly applied to practice without modification, yet it would appear that laboratory research may eventually offer the best general solution for portions at least, and possibly for the whole of the problem.

The effect of grades and changes in acceleration can be accurately calculated, and Prof. Denton has very thoroughly investigated the friction of car journal bearings.* Prof. Goss has collected much important data regarding the internal friction of locomotives, not yet made public, and has also made an extended study of the resistance to the motion of trains offered by the atmosphere, the results of which are given in another portion of this issue.

The method used by Prof. Goss in his study of the atmospheric resistance to trains is novel and his deductions go so far toward explaining the contradictory evidence from former tests that we have reprinted the greater portion of his paper. For those readers, however, who have neither the time nor inclination to read so long an article, a statement of the important points may not be out of place.

Briefly stated, the apparatus consisted of small models, $\frac{1}{32}$ the size of a standard box car, placed near the center of a long wooden conduit, as this portion was found by experiment to have a nearly uniform flow of air, when a rotary fan connected to one end of the conduit was in operation. Each car was attached to a dynamometer which registered the force tending to produce longitudinal displacement, while the velocity of the air was measured by suitable gages and controlled by regulating the speed of the fan. The observations consisted in measuring the velocity of the passing air current and noting the readings of the dynamometers of the several cars. The atmospheric conditions of the tests corresponded to those of a train moving in still air, and no effort was made to determine the effects resulting from oblique or other winds. Various arrangements of the models were tried ranging from a single model to a train of twenty-five models and the velocity of the air was varied from about 25 to 105 miles an hour. The conclusions drawn from the results of these experiments are:

1. The force with which the air current acts upon each element of the train, or upon the train as a whole, increases as the square of the velocity.

2. The effect upon a single model, standing alone, measured in terms of the pressure per unit area of cross-section is approximately 0.5, the pressure per unit area as shown by the gage recording the pressure of the air current.

3. The effect upon the different models composing a train varies with different positions in the train; it is most pronounced upon the first model, the last model coming next in order, then all the intermediate models excepting the second, and least of all is the effect of the air upon the second model.

4. The relative effect upon different portions of a train is approximately the same for all velocities.

5. The ratio of the effect upon each of the several models composing a train, measured in pressure per unit area of cross-section, compared with the pressure per unit area of the air current as shown by the gage is approximately: for the first model 0.4; for the last model 0.1; for any intermediate model between the second and last 0.04; and for the second model 0.032.

It is then assumed that had the models been full-sized cars under similar conditions, the results would have varied according to the extent of the exposed surfaces, and from the data obtained from the experiments with model trains, equations are evolved, expressing the relation between the speed of locomotives, passenger trains and freight trains, and the resistance offered by still air to their progress. Twelve equations are thus presented for different combinations, which equations take into account both the cross-section and the length of the train and distinguish between the head resistance and the frictional resistance of the intermediate cars. So far as we know this is the first time equations of this kind have been brought out. The results of the application of these formulae are given in tabular form, which tables show the tractive power and horse-power required to overcome the atmospheric resistance, for speeds of from 10 to 100 miles an hour of a locomotive running alone and at the head of a train, and also of trains varying from 100 to 2,000 ft. long. These values are much lower than those obtained from the application of several well-known formulae, which formulae are now considered by those best informed to give results too high.

The scheme of these experiments is ingenious, and the results are presented in such a way that they can be readily adapted to almost any general case, provided it is correct to assume that the relative atmospheric effects on similar bodies are directly proportional to their respective surfaces. As the final expressions depend largely for their values upon the relation that exists between the effects upon small and large similar bodies, it would seem very desirable to establish this relation by trial, at least within the limits of the apparatus. If, for instance, the relation between the effects of models, even $\frac{1}{64}$, $\frac{1}{32}$ and $\frac{1}{16}$ the size of the standard car were found to be directly proportional to the area of surfaces exposed, one would feel more safe in applying the experimental results to actual conditions; doubtless this relation could be determined for a wider range of sizes in other ways.

However, the equations deduced by Prof. Goss are more rational and satisfactory than any heretofore presented, and will probably be found satisfactory for practical purposes.

*Transactions of the Am. Soc. M. E., Vol. XII.

The Railroad Commissioners of Texas have prepared a review of their work for the past year, to be read at the convention of Railroad Commissioners held in Washington this week. From a copy of this review, published in the Galveston News, we learn that the Commissioners are able to assure the people of Texas that reductions in rates have been ordered by the Commission during the past year sufficient to save the people not less than $1,800,000. Yet the Commissioners claim to be conservative, and they assert that there has been a steady increase in both gross and net earnings on the railroads each year since the Commissions began, which was in 1891. For the last year before the Commission was established the average receipts of the railroads for freight per ton per mile amounted to 1.403 cents. For the year ending June 30, 1897, the ton mileage was about 50 per cent. larger and the average receipts 1.091. The Commissioners have employed experts to examine the books of the railroads, and they have secured evidence of illegal rebates and other discriminations to such an extent that 95 fines of $500 each have already been paid into the State Treasury, and $20,000 more is expected to be taken in during the next few months. The Commissioners, after a long contest in the courts, have established their tariff of rates for express companies. Under this tariff they expect to save the people of Texas at least $100,000 a year. The average reduction in the price of transportation of cotton made by the Commissioners (to the seaboard from all points in the state) is estimated to be 6.8 cents per 100 lbs.

The Southwestern Traffic Bureau has been reorganized as the Southwestern Bureau, and the Kansas City, Pittsburgh & Gulf has joined it. The old agreement expires May 31, and the new one becomes effective June 1. The new Executive Board will consist of Messrs. Stubbs of the Southern Pacific, Fordyce of the Cotton Belt, Morton of the Atchison, Truesdale of the Rock Island, Robert Mallory of the Mallory Line, Miller of the Missouri, Kansas & Texas, Yoakum of the 'Frisco, Martin of the Kansas City, Pittsburgh & Gulf, and Thorne of the Texas & Pacific. Col. Fordyce has been elected Chairman and E. T. Campbell, Secretary. The headquarters of the Bureau will remain at St. Louis. The inclusion of the Kansas City, Pittsburgh & Gulf in the new Bureau is likely to contribute materially to the maintenance of rates in the Southwest. This line has heretofore steadfastly refused to become a member of the Traffic Association and has been a "thorn in the flesh" of the other lines. It will be remembered that the other lines some months since discontinued through tariffs with the "P. G.," and the latter secured a temporary injunction, the Court finally refusing, however, to make it permanent. Southwestern traffic men are now quite enthusiastic over the prospects of the new Association and the future maintenance of rates in that territory.

NEW PUBLICATIONS.

Coal Catechism.—By William Jasper Nicolls, M. Am. Soc. C. E. 12mo., 218 pages, with index. Philadelphia: J. B. Lippincott Co., 1898. Price, $1.50.

Mr. Nicolls tells us in his preface that this "catechism of coal" is intended for that great number of intelligent readers who have no technical training, and yet prefer to seek knowledge by reading special subjects rather than fiction." He tells us also that "in justification of the catechetical form used, the writer refers to the old educational catechisms used by our forefathers." His little volume is an elementary but comprehensive handbook of information about coal, put into the form of questions and answers. He takes up first its geology and geography, then deals with the volume of production, with classification, and then with the methods of mining and preparing and transporting coal, and concludes with its various uses, which, naturally, involves some discussion of heat and power. In all there are 20 chapters. As an example of the method, we may take two or three questions, opening the book at random:

"228. How is the relative value of fuels determined?

"The relative value of fuels is determined by the quantities of water evaporated by a certain weight of each fuel."

"329. Is natural ventilation sufficient?

"It might be if there were no other influence at work vitiating the air of mines, such as occluded gases."

"479. What is the tide water tonnage of the Chesapeake & Ohio Railroad?

"About 12 per cent. of the whole, which reaches the Atlantic seaboard at Newport News, on Hampton Roads, Virginia."

The information is all very simply told and made available by a good index. Physically, the volume is admirable as to paper, typography, binding and proportions.

Unique Long Island.—This is a summer advertisement issued by the Long Island Railroad, and the book itself is unique in having no text whatever, beyond the title page. It is a book of about 100 pages, filled with direct process cuts and showing all kinds of life and scenery on Long Island. The work is all first class, and the photographs, mostly by amateurs, have been selected with such good judgment that one hardly feels the absence of descriptive matter.

TRADE CATALOGUES.

Fairbanks, Morse & Co.—This company has just issued an 88-page 6 in. x 9 in. catalogue dealing with the machinery and apparatus included in the railroad department of that company. Many of the goods referred to in this catalogue, such as scales, steam pumps, boilers and gasoline engines, are described more fully by complete catalogues of the different apparatus. In the catalogue just issued wind mills and pumps, the Sheffield hand and push cars, velocipede and motor cars and stand pipes are illustrated and described. Much of the new machinery treated of here has been referred to in one way or another in past issues of "The Railroad Gazette." A very complete index is given on the second page.

Metal Bolsters.—The Simplex Railway Appliance Co., Fisher Building, Chicago, has sent us a pamphlet, illustrating by half-tone and line engravings the Simplex metal body and truck bolsters; cuts also show the combination of these bolsters with the ordinary arch bars to form an all-metal, diamond-frame truck. The statement is made that the Simplex bolster is now in use on twenty different railroads, and when it is considered that this bolster has been on the market less than a year, an idea is gained of how rapidly metal bolsters are taking the place of the old wooden types.

Atmospheric Resistance to the Motion of Rairroad Trains.

(*Continued from page* 359.)

In general it will be sufficiently accurate if each coach is made equal to two freight cars. Thus, a train of five coaches following a locomotive and tender may be considered equivalent to 12 units of which the locomotive and tender each count one. Numerical results may then be found as already described.

Resistance Offered to any Train in Terms of its Length.—It is evident that a car length of 33 ft. as a unit of measurement is subject to some limitation. The equations already deduced, however, may be transformed into equivalent expressions in which the length of the train is expressed in feet rather than in number of cars. Thus, considering the locomotive and tender as cars, the resistance of the whole train may be expressed in terms of the resistance of an intermediate car. If the actual number of cars is N, and the equivalent number of intermediate cars D,

D=number of intermediate cars equivalent to first car (locomotive)+number of intermediate cars+number of intermediate cars equivalent to last car

$$=\frac{.099}{.010}+(N-2)+\frac{.026}{.010}$$

$$=9.9+N-2+2.6=N+10.5$$

So that the total resistance of any number of cars composing a train, when the locomotive and tender are each regarded as a car, is equivalent to the resistance of one intermediate car multiplied by the number of cars plus 10.5. But the resistance of an intermediate car is $.010V^2$, consequently that of the whole train is

$$A \text{ (locomotive and train)}=.01(N+10.5)\ V^2 \quad ..(12)$$

where A is the number of pounds tractive force necessary to keep the train in motion against the resistance of the atmosphere, N the number of 33-ft. cars in the train, of which number the locomotive and tender are each counted one, and where V is the velocity in miles an hour.

Again, if the length of the train in feet is represented by L, then

$$L=N\times 33$$

or,

$$N=\frac{1}{33}L$$

Substituting this value of N in equation 12 gives

$$A \text{ (locomotive and train)} = .01\left(\frac{L}{33}+10.5\right)V^2 = .0003\ (L+347.)\ V^2 \quad ....(13)$$

which is the tractive force necessary to overcome the atmospheric resistance of the entire train when the length of the train in feet is known. Thus, a locomotive and train which measures 800 ft. in length would be resisted, when running at a speed of 40 miles an hour, by a force of

$$A=.0003(800+347)\ 1600=551$$

By a similar process the resistance of the train following behind a locomotive may be expressed as

$$A \text{ (excluding locomotive and tender)} = .0003\ (l+53)\ V^2 \quad (14)$$

where l is the length in feet of the train, excluding locomotive and tender. Thus, if, in the example just assumed, the locomotive and tender were 66 ft. long, the train following the tender would have been 800—66=734. The pull of the tender drawbar when running at a speed of 40 miles an hour will be

$$A=.0003\ (734+53)\ 1600=378. \text{ pounds.}$$

In determining values for L and l in equations 13 and 14 the length of the car bodies only is to be considered, since whatever resistance may arise because of the space between the cars, is in each case included in the value of the constant appearing in the equation. It is unnecessary, also, to express the length of train with absolute exactness, since an error of one foot in the length of the train introduces an error of only one pound in the calculated result when the speed is 60 miles an hour; for a lower speed the error arising from errors in the length of the train are less than this.

Conclusions.—The experiments already described and the results deduced therefrom justify certain conclusions. It will be well to note in this connection that the conclusions here given apply to trains and parts of trains having an area of cross-section equal to that which is common in American practice; also that being intended for general use they should not be expected to apply strictly in any individual case. Their application may, in individual cases, lead to errors of from 15 to 20 per cent., but even with this limitation the conclusions given are vastly superior to any that have hitherto been offered; and with this limitation also they will doubtless be found entirely sufficient for every requirement arising in practice. The conclusions are as follows:

1. The resistance offered by still air to the progress of a locomotive and tender running at the head of a train is approximately ten times greater than that which acts upon an intermediate car of the same train.

2. The resistance offered by still air to the progress of the last car of a train is approximately two and a half times greater than that which acts upon an intermediate car of the same train.

3. The resistance offered by still air to the progress of trains and parts of trains may be expressed in the form of equations in which A is the tractive force in pounds necessary to overcome the resistance of the atmosphere, and V is the velocity in miles per hour. Such equations in which the values of constants are given to two significant figures are as follows:

a. For a locomotive and tender running alone:

$$A=.13V^2$$

b. For a locomotive and tender running at the head of a train:

$$A=.11V^2$$

c. For the last car of a train of freight cars:

$$A=.026V^2$$

d. For the last car of a train of passenger cars:

$$A=.036V^2$$

e. For each intermediate freight car in a train of 33-ft. cars:

$$A=.01V^2$$

f. For each intermediate passenger car in a train of 66-foot cars:

$$A=.02V^2$$

g. For a train consisting of locomotive, tender and freight cars:

$$A=(.13+.01C)V^2$$

where C is the number of cars in the train.

h. For a train consisting of locomotive, tender and passenger cars:

$$A=(.13+.02C)V^2$$

where C is the number of cars in the train.

i. For a train of freight cars following a locomotive, but not including either locomotive or tender,

$$A=(.016+.01C)V^2$$

where C is the number of cars in the train.

j. For a train of passenger cars following a locomotive, but not including either locomotive or tender,

$$A=(.016+.02C)V^2$$

where C is the number of cars in the train.

k. For a locomotive and any train, either freight or passenger,

$$A=.0003(L+347)V^2$$

where L is the length of the train in feet.

l. For a train of cars, either passenger or freight, following a locomotive, but not including either locomotive or tender,

$$A=.0003(l+53)V^2$$

where l is the combined length of the cars composing the train.

4. A partial summary of results in convenient form is presented as Tables VII., VIII. and IX.

TABLE VII.

Resistance Offered By Still Air To the Progress of a Locomotive and Tender.

Speed in Miles per Hour.	Locomotive and Tender Running Alone. Tractive Force.	Horse Power.	Locomotive and Tender Running at the Head of a Train. Tractive Force.	Horse Power.
10	13	0.35	11	0.29
20	52	2.8	44	2.3
30	117	9.4	99	7.9
40	208	22.	176	19.
50	325	43.	275	37.
60	468	75.	396	63.
70	637	119.	539	101.
80	822	178.	704	150.
90	1050	253.	891	214.
100	1300	347.	1100	293.

Table VIII—Resistance Offered by Still Air to the Progress of a Train Consisting of a Locomotive, Tender and Cars.

Speed in miles per hour.	Length of Train, including Locomotive and Tender. 100 feet. Tractive force.	Horse power.	200 feet. Tractive force.	Horse power.	300 feet. Tractive force.	Horse power.	400 feet. Tractive force.	Horse power.	600 feet. Tractive force.	Horse power.	800 feet. Tractive force.	Horse power.	1,000 feet. Tractive force.	Horse power.	1,500 feet. Tractive force.	Horse power.	2,000 feet. Tractive force.	Horse power.
10	13	0.36	16	0.44	19	0.52	22	0.60	28	0.76	34	0.92	40	1.1	55	1.5	70	1.9
20	54	2.9	66	3.5	78	4.1	90	4.8	114	6.0	138	7.3	162	8.6	222	12.	282	15.
30	121	9.7	148	12.	175	14.	202	16.	256	21.	310	25.	364	29.	499	40.	634	51.
40	215	23.	263	28.	311	33.	359	38.	455	49.	551	59.	647	69.	8-7	95.	1,130	120.
50	335	45.	410	55.	485	66.	560	76.	710	95.	860	115.	1,010	1 5.	1,390	185.	1,760	235.
60	483	77.	590	95.	699	112.	807	129.	1,020	164.	1,240	198.	1,460	233.	2,000	319.	2,540	406.
70	657	12?.	804	150.	951	177.	1,100	205.	1,390	260.	1,690	314.	1,980	368.	2,720	507.	3,450	646.
80	858	183.	1,050	224.	1,240	265.	1,430	306.	1,820	388.	2,?00	470.	2,590	552.	3,550	756.	4,510	961.
90	1,090	261.	1,330	319.	1,570	377.	1,820	436.	2 300	552.	2,790	669.	3,270	786.	4,490	1,080.	5,700	1,370.
100	1,340	358.	1,640	438.	1,940	518.	2,240	598.	2,840	758.	3,440	918.	4,040	1,080.	5,540	1,480.	7,040	1,880.

Table IX—Resistance Offered by Still Air to the Progress of that Portion of a Train which Follows a Locomotive Tender.

Speed in miles per hour.	Length of Train, excluding Locomotive and Tender. 100 feet. Tractive force.	Horse power.	200 feet. Tractive force.	Horse power.	300 feet. Tractive force.	Horse power.	400 feet. Tractive force.	Horse power.	600 feet. Tractive force.	Horse power.	800 feet. Tractive force.	Horse power.	1,000 feet. Tractive force.	Horse power.	1,500 feet. Tractive force.	Horse power.	2,000 feet. Tractive force.	Horse power.
10	4.6	0.12	7.6	0.20	11	0.28	14	0.36	:0	0.52	26	0.68	32	0.84	47	1.2	62	10.6
20	18.	0.98	30.	1.6	42	2.3	54	2.9	78	4.2	1?2	5.5	126	6.7	186	9.9	246	13.
30	41.	3.3	63.	5.5	95	7.6	122	9.8	176	14.	230	18.	284	23.	419	34.	554	44.
40	73.	7.8	121.	13.	169	18.	217	23.	313	33.	409	47.	505	54.	745	79.	985	105.
50	115.	15.	190.	25.	265	?5.	340	45.	490	65.	640	85.	790	105.	1,170	155.	1,540	205.
60	165.	26.	273.	44.	381	61.	489	78.	705	113.	921	147.	1,140	182.	1,680	268.	2,220	355.
70	225.	42.	372.	69.	519	97.	666	124.	960	179.	1,250	234.	1,550	289.	2,280	426.	3,020	563.
80	294.	63.	483.	104.	678	145.	870	186.	1,250	268.	1,640	349.	2,020	431.	2,980	636.	3,940	841.
90	372.	89.	615.	148.	858	206.	1,100	264.	1,590	380.	2,070	497.	2,560	615.	3,770	906.	4,990	1,200.
100	459.	122.	7:9.	202.	1,060	282.	1,360	:62.	1,960	522.	2,:60	682.	3,16	842.	4,660	1,240.	6,160	1,640.

Electric Railroad Building in Japan.

If present plans are carried out, Japan, or at least the largest of the four islands which constitute that country, the Nippon, will in a few years resemble the United States in respect to electric railroads. Until recently but two cities in Japan, Yyoto and Nagoya, had an electric street railroad, but there are now several lines in other parts of the island of Nippon building or soon to be built.

We show a map of Tokio on which lines that have charters to build electric railroads are sketched. Shortly after the authorities were convinced of the propriety of allowing the streets of that city to be used for other than horse-car lines and the jinrikisha no less than fifty companies were organized to take out charters. Some proposed using the overhead trolley, in one case with a single and another with a double trolley wire; some wanted the underground conduit; others favored compressed air or ammonia motors. At last the fifty companies, by consolidation or by being compelled, for one reason or another, to give up their charters, dwindled down to two independent companies, which have been permanently organized. They are the Tokio Electric Railway Co. (Tokio Denki Tetsudo Kaisha), the larger, and the Tokio Electric Car Railway Co. (Tokio Densha Tetsudo Kaisha).

The former will control all lines shown on the eastern half of the city, aggregating 100 miles (single track), all of which is to be built within five years. Twenty miles of existing horse-car lines will also be changed to electricity. Additional roads aggregating about 200 miles (see map) will be taken up immediately after the first 120 miles are finished. This also applies to the Tokio Electric Car Railway Co., which will operate the lines in the western portion of the city.

All the routes of the former company are shown in full, but a few miles of the latter had not been determined at the time the map was prepared, and are therefore omitted.

The present capital stock of the Tokio Electric Railway Co. is $2,500,000, which will be increased after the first 50 miles of road have been finished. The committee of stockholders (no directors have yet been chosen) consists of Ichisuke Fujioka, M. E., Dr. E., Chairman; K. Amenomiya, M. Tsuchida, S. Iwata, S. Takagi, K. Hiroshi, I. Kitani, M. Yokoyama, U. Tachikawa and T. Matsumoto.

The chairman, Mr. Fujioka, is now in the United States looking into the various electric systems, both for propulsion and lighting. For three years Mr. Fujioka was a Professor of Electrical Engineering in the Imperial University at Tokio, resigning in 1887 to become lecturer on electricity for the same university, which position he has relinquished temporarily to devote his time to electric railroad building. He received the degree of Doctor of Engineering from the Minister of Education of Japan, by direction of the Emperor, in 1892. Within the past few days he has received notice of a decoration given by the Emperor in recognition of his services to the Government.

Through the courtesy of Mr. Fujioka we are enabled to give his estimates of the cost of building the first 50 miles of road, based on an overhead trolley system:

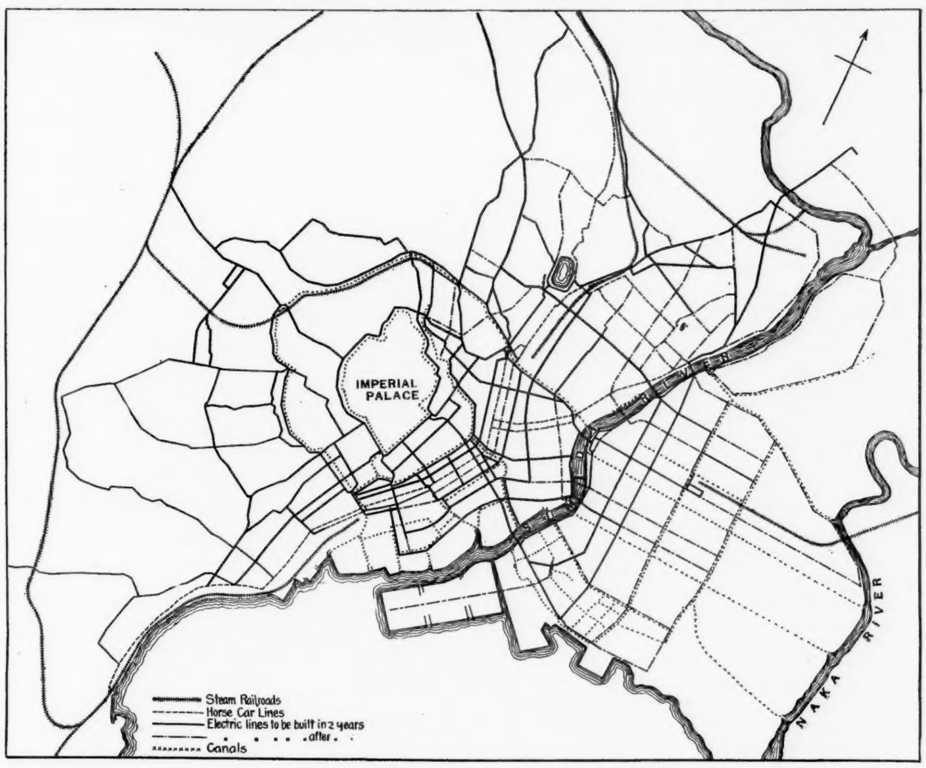
Rails	$250,000
Ties and labor of laying tracks and paving	250,000
Underground feed wires	250,000
Trolley wire	25,000
Return wires and track bonds	30,000
Steel poles	35,000
Labor in putting up poles and wires	10,000
Motor cars (200)	400,000
Trailer cars (100)	75,000
Power station (5,000 H.P.)	500,000
Rotary transformer stations (8)	300,000
Underground high tension wires	180,000
Buildings (car barns, etc.)	25,000
Bridges, culverts, etc	75,000
Real estate	75,000
Miscellaneous expenditures	20,000
Total	$2,500,0000

A central power station will be built on a river about five miles from the center of the city, and the power delivered to the trolley lines by eight transformer stations placed at proper points in the city. The roads will be double track, and the streets through which they pass must measure at least sixty feet.

As there is some opposition on the part of the Government engineer to the overhead trolley system, its use may not be permitted; but Mr. Fujioka is collecting data representing the extensive use of overhead construction in this country, with which he hopes to convince the authorities of the minimum danger involved.

Mr. Fujioka has just placed orders in this country for equipping an eight-mile horse car line of 4 ft. 6 in. gage, running from Kozu west to a hot spring at Yumoto, with electricity. The power station will be located about one-half mile from Yumoto, where a head of water of 400 ft. will be utilized to develop 1,000 H. P. by means of four Pelton water wheels. Two Walker three-phase generators of 3,500 volts and two rotary transformer stations will be used. Fifteen motor and 15 trailer cars will constitute the equipment. The car bodies are to be built in Japan, and the motor cars equipped with Walker generators and controllers. Peckham trucks, with New York wheels, will be used on the 30 cars. The track will have 60-lb. T rails, with Crown bonds.

Several other suburban lines are to be built, the most important of which is probably that between Tokio and Yokohama, 18 miles, which will practically parallel a steam railroad. The Government charter for about one-half this distance has already been obtained. Among other roads are the following: Kobe to Amagasaki and Osaka, 20 miles; Kobe to Arima, 17 miles; Setsupan Electric Railroad, Kobe to Akashi, 10 miles; Horinouchi Electric Railroad, Shinjuku (Tokio) northwest to Horinouchi, 5 miles, with an ultimate extension 15 miles further in the same direction; Kawasaki Electric Railroad, Awoyama (Tokio) southeast to Kawasaki, 12 miles; Daishi Electric Railroad, Kawasaki east to Daishi, 1½ miles, the materials for which have all been ordered, including Walker generators and Walker motors and Peckham trucks for four cars; Narita Electric Railroad, from near Sakura, to Narita, seven miles; Owu Electric Railroad, from Shiogama, a town five miles east of the city of Sendai, west to Yamagata, 30 miles, and the Ikao Electric Railroad, from Takasaki north to Ikao, about 18 miles.



Sketch Map of Tokio, Showing Proposed Electric Railroads.

TECHNICAL.

Manufacturing and Business.

The Falls Hollow Staybolt Company announces that as a result of reduced prices and recognized excellence of material and workmanship in their product, their trade is increasing fast. Customers say that they much prefer the improved rolled hollow staybolt to one drilled or punched, not only because of less cost, but of better performance.

The Link Belt Machinery Co. has recently established an office in Denver, Col. A. E. Lindrooth is the engineer in charge.

The Rice Machinery Co., Chicago, Ill., has recently furnished machinery for the Great Northern machine shops at West Superior, Wis.

The Ashland Steel Co., Inc., Ashland, Ky., will soon begin the erection of a rod mill.

Monarch brake beams, made by the Monarch Brake Beam Co., Ltd., Detroit, Mich., have been specified for 1,000 box and 50 coal cars for the Illinois Central. Monarch "Solid" beams will be applied to 50 cars for the Pecos Valley, just ordered from Pullman's Palace Car Co., and to eight locomotives ordered from the Brooks Locomotive Works.

Iron and Steel.

The Lochiel furnace of Harrisburg, Pa., which has been idle for some time, will shortly start to manufacture spiegel iron for the Pennsylvania Steel Co. of Steelton, Pa.

The Ashton Valve Co., Boston, Mass., has declared a quarterly dividend of 1½ per cent., payable May 15 to stockholders of record May 1.

The Aetna Standard Iron & Steel Co., Bridgeport, O., has recently installed a large sheet mill which is now being run double turn.

Six shapers, five planers, one slotter and three lathes will be placed in the new machine shop of the American Steel Casting Co. at Sharon, Pa.

The Government has advertised for proposals to be received until 12 o'clock noon, May 24, for furnishing 7,700 tons, more or less, of nickel steel armor, bids to be accompanied by certified checks for 10 per cent. of the aggregate of the bids.

On May 14 proposals were opened in Washington for furnishing to the Government 1,019 8-in. armor piercing shot, capped; 1,084 8-in. armor piercing shells, 796 10-in. armor piercing shot, capped; 786 10-in. armor piercing shells, 477 12-in. armor piercing shot, capped; 780 12-in. armor piercing shells, 385 12-in. torpedo shells, weighing 800 lbs. each, and 396 12-in. torpedo shells, weighing 1,000 lbs. each. Among the bidders were the following companies: Midvale Steel Co., Carpenter Steel Co., Firth-Sterling Steel Co., and Taylor Iron & Steel Co.

The rolling mills of the Consolidated Joint Co., Muskegon, Mich., will resume operation under the direction of the Michigan Iron & Steel Co. These mills have been shut down for some time on account of litigation.

New Stations and Shops.

The buildings to be erected at Cleburne, Tex., by the Gulf, Colorado & Santa Fe, according to the latest revised plans, are: One stone machine shop, 340 x 120; one wood and iron boiler shop, 340 x 90; one stone paint shop, 180 x 90; one stone car shop, 180 x 90; one wood and iron engine and boiler house, 88 x 40; one wooden coal house, 22 x 40; one two-story stone office building, 40 x 66; one wood and iron store house, 200 x 40; one fire department building, iron, 25 x 40; one iron water tower, 16 x 100; one stone oil house, 30 x 60; one iron electrical room, 20 x 40; stone transfer pits, 70 x 360; one round stack, of brick construction, 100 ft. high, 16 x 9; covered platform, 100 x 40; iron tool house, 30 x 60.

The new power station and car house being erected by the Spencer, Warren & Brookfield Street Railway Company, at Brookfield, Mass., will have steel roof trusses and covering furnished by the Berlin Iron Bridge Company. The dynamo and engine room roofs will be lined with the Berlin Company's patent anti-condensation roof lining, now largely used for roofs of this nature throughout the country. It prevents the condensation of moisture from the under side of the roof covering, which, if it should collect and drop upon the machine beneath, would cause considerable damage.

The Covington and Cincinnati Bridge.

In our issue of Sept. 17, 1897, page 645, appeared an account of the work now in progress in the way of enlarging and partially rebuilding the famous suspension bridge over the Ohio River between Cincinnati and Covington. This involves two additional main cables with their anchorages and a radical rebuilding of the suspended structure and approaches. The new cables are each 1,970 ft. long and 10½ in. in diameter, and, of course, of steel wire. The old cables were 1,700 ft. long, 12½ in. diameter and of iron wire. The work of rebuilding began in August, 1895 (Mr. William Hildebrand, Chief Engineer), and is now near completion. The new floor and street railroad tracks are not yet laid and the new footwalks are not yet finished.

Pintsch Gas Lighting on Railroads.

At present the Pintsch system of gas lighting is in use on 85,600 cars and locomotives in the world. In but few of the countries where this method of lighting has been used has it been applied to the locomotive, and Germany is the only country that has so applied it to any considerable extent, there being at the end of last year 2,955 locomotives in that country lighted by the Pintsch system. Brazil comes next with but 31 such installations, and it is furthermore worthy to note that Germany is the only country where the number of such installations has increased from the end of 1896 to the end of 1897, the increase in this case being 166. Last year there were 6,089 coaches equipped, and it is of interest to note in what countries the increase has been the greatest during the year 1897, as given in the appended table. In 1883 there were but 11,422 installations on cars and locomotives. In five years the number had increased to 26,100, and in ten years to 54,175. In the table below is shown the increase for 1897 of the number of complete car equipments in a few of the countries where the Pintsch light is used:

At the close of year—	1897.	Inc. during 1897.
Germany	31,335	1,151
England	16,854	626
France	5,210	218
Italy	1,522	137
Austria	3,104	228
Russia	1,536	179
Brazil	949	18
Argentine	984	24
India	6,356	1,601
Australia	976	634
United States	10,809	190

Subjects for the Master Mechanics.

The Master Mechanics' Association Committee on Subjects has sent out a circular asking for a list of subjects to be discussed by the convention of 1899, both for committee reports and for topical discussion. Replies should be addressed (before June 5) to Mr. C. H. Quereau, care of the Denver & Rio Grande Railroad, Denver, Col.

Pig Iron Production in April.

With the exception of a moderate increase in the production of charcoal pig iron, there has been no change in the rate of production during the month of April, which was about 1,000,000 tons a month. According to the Iron Age, there were 194 furnaces in blast May 1, with a weekly capacity of 234,163 gross tons against the same number of furnaces in blast April 1, with a weekly capacity of 233,339 gross tons and against 146 furnaces in blast May 1, 1897, with a weekly capacity of 170,529 gross tons. Stocks sold and unsold amounted to 841,524 tons on May 1, against 818,008 the month previous.

Another Three-Cylinder Compound.

A compound engine of new design is being made for the North Eastern Railway of England at the Gateshead works. It is an old express engine built in 1893 as a two-cylinder compound, and is being rebuilt as a three-cylinder engine, with one inside high-pressure cylinder, 20 in. diameter by 26 in. stroke, and two outside low-pressure cylinders, each 19 ins. diameter by 24 in. stroke. A boiler of large dimensions will be provided, having a firebox 8 ft. long—an unusual size for a British locomotive. The working pressure is to be 220 lbs. per square inch.

Westinghouse Air Brake Company.

A proposition is on foot to increase the capital stock of the Westinghouse Air Brake Company, and a special meeting of stockholders is called for July 12 to act upon the matter The present stock is $5,000,000 in $50 shares, and the proposition is to increase it to $12,000,000. Inasmuch as the plan originates with the heaviest stockholders, there is scarcely any doubt that it will be carried through.

Compressed Air Motors in New York.

In our last week's issue, page 341, we announced that the contract had been made by the Metropolitan Street Railway Co. of New York for the complete equipment of compressed air machinery, together with 20 Hoadley-Knight compressed air motors. These cars will run between the Twenty-third street ferry on North River, and Thirty-fourth street ferry on the east side. The route is as follows: From the Twenty-third street ferry up Thirteenth avenue to Twenty-ninth, thence east to First avenue, north to Thirty-fourth and east on Thirty-fourth to the Hunter's Point ferry. Returning, the same route will be taken as far as Twenty-ninth street and First avenue,

whence the course will be down First avenue to Twenty-eighth street, thence east to the river and south to the starting point. For a description of the Hoadley-Knight motors which are to be used see issue of Dec. 31, 1896.

THE SCRAP HEAP.

Notes.

Passenger train No. 3 of the Alabama Great Southern was stopped by five masked robbers on the night of May 14 near Cuba, Ala., and $500 was stolen from the express car.

Armour elevator "D" at Brown and Lumber streets, Chicago, owned by the Chicago, Burlington & Quincy Railroad, was destroyed by fire on May 12, with over a million bushels of grain, and the fire spread to a number of adjoining buildings and lumber yards. The total loss is estimated at $960,000; about 5,000,000 ft. of lumber and a number of freight cars being destroyed.

The Post Office Appropriation bill, as finally agreed to by the Conference Committee of the two Houses of Congress, provides for a Joint Commission of three Senators and three Representatives to make an extended investigation of the prices paid to the railroads, postage rates and the postal service generally as it affects railroads. The bill forbids further contracts for pneumatic tubes in cities, except under specific authority from Congress. The proposed amendment, making it a misdemeanor for railroads to fail to furnish suitable postal cars or to carry the mails on the fastest trains, was rejected.

A Baltimore correspondent notes that on the fourth of next July it will be 70 years since the corner stone of the Baltimore & Ohio Railroad was laid in Baltimore, by Charles Carroll of Carrollton, last surviving signer of the Declaration of Independence, and that last week the tools used by Gen. Carroll were removed from the B. & O. treasurer's vault to the Masonic Temple in Baltimore. They consist of a trowel, a spade and a stone cutter's hammer, also badges, and the apron worn by Thomas Young Nichol, a working stone mason, who performed the actual labor of setting the corner stone in its place.

The Appellate Division of the Supreme Court of New York, Second Department, has affirmed a judgment of $1,000 against the Long Island Railroad in a suit for damages brought by John J. Lewis, who was injured in the highway crossing accident at Valley Stream, May 30, 1897. This has been called a test case, but from the reports of the decision it seems doubtful whether the facts on which it was based are the same as those connected with some of the other cases. Lewis was sitting 15 ft. from the driver of the omnibus, and the question of the negligence of the driver seems to have been a minor issue. The principal points against the railroad company which weighed with the court were the dense forest close to the railroad and close to the highway, and the insufficiency of the sign, which was held not to be a "conspicuous sign," as required by law. Furthermore, the jury believed the testimony of witnesses who claimed that the locomotive whistle was not blown, and the court accepts this verdict. The railroad company will carry the case up to the Court of Appeals.

New Passenger Cars for the Chicago, Milwaukee & St. Paul.

One of the new "Pioneer Limited" trains of the Chicago, Milwaukee & St. Paul was exhibited at the Union station, Chicago, on May 16, to a large number of invited guests. Two of these trains were recently finished by the Barney & Smith Car Co., and are to go into regular service between Chicago and Minneapolis on May 22. Each train consists of ten cars, furnished with every modern convenience and luxury and having all of the sumptuous fittings and furnishings usually found in trains of this class.

In the front end of the baggage car are a Westinghouse engine and dynamo for lighting the train, and there is a storage battery under each car, capable of lighting about twelve lamps. The baggage car has neat and compact racks for bicycles.

The buffet car has a smoking compartment, a card room and a buffet, the card and smoking compartments being divided by a bronze grill arch, supported by columns. The standard sleeping cars are 4 in. wider and 6 in. higher than is usual, and 72 ft. long. They contain sixteen sections and are divided in the middle by columns supporting arches in which are placed oxidized grill work. There are also compartment sleepers having seven double compartments and two drawing rooms. The day coaches have seats of a new design, and each has a separate smoking room and toilet rooms at the ends. The parlor and reclining chair cars are also supplied with smoking and toilet rooms, and the dining car is handsomely finished in Empire style.

The cars all have wide vestibules, finished in mahogany and lighted by electric lamps. The various woods used for the interior are richly carved and inlaid, and, combined with the handsome upholstery and hangings, give gorgeous effects of color and texture. The exterior of the train is painted in different shades of yellow and decorated in gold. The two trains are said to have cost $250,000.

The Regiment of Volunteer Engineers.

In our issue of May 6 we noted at some length the effort being made by Capt. Eugene Griffin, Vice-President of the General Electric Co., and Mr. William Barclay Parsons, Chief Engineer of the Rapid Transit Commission, New York, to get up a regiment of engineers. Such civil, mechanical and electrical engineers and enginemen, mechanics, artisans and draughtsmen are wanted as are capable of being quickly turned into military engineers, and it is desired that all these classes be reached. Mr. B. E. Sunny, Monadnock Block, Chicago, is prepared to furnish information and enlistment blanks, and the Chicago Electrical Association has sent out a circular to its members advising them of this movement, and requesting that they in turn inform their associates with whom they come in contact.

A Heavy Train.

On Tuesday, May 10, the Chicago & Eastern Illinois hauled from Danville, Ill., to Chicago, a freight train of which the paying load was 2,200 tons. It consisted of 55 cars of coal, each carrying 80,000 lbs., and the gross weight, including engine, tender and caboose, was 6,510,000 lbs. This load was made up for the purpose of testing one of the company's new consolidation locomotives. This engine, No. 129, has 143,000 lbs. on the drivers and has cylinders 21 in. x26 in. The run of 106 miles was made at an average of about 20 miles an hour, excluding stops. The ruling grade is 21 ft. to the mile, and there are a number of grades of about 15 ft. per mile. The weight of the different parts of the train is given as follows:

Locomotive, with tender	268,000
Cars, each 16½ tons	1,815,000
Coal, 40 tons in each car	4,400,000
Caboose	27,000
Total weight of train, pounds	6,510,000

The Brooks Memorial Hospital and Library.

We noted briefly last week the gift to the Young Men's Association of Dunkirk, N. Y., of the homestead of the late Horatio G. Brooks, founder of the Brooks Locomotive Works. From a copy of the Dunkirk Herald, since received, we learn that the gift includes not only the residence, but the large building, heretofore used as a hall, on Eagle street. The grounds, containing both the hall and the dwelling, embrace about 64,800 square feet. The whole property is valued at about $100,000. From the letter accompanying the gift it appears that the principal givers are Mrs. Alfred Solano and Mrs. F. H. Stevens, daughters of Mr. Brooks. The givers propose that the dwelling house be used either for a hospital or a free library, or both, and the other building for a home for the Association.

Wireless Telegraphy.

A paper on wireless telegraphy recently read by Captain Kennedy of the Royal Engineers, second Division, Telegraph Battalion of the English Army, before the Royal United Service Institute, would seem particularly interesting at the present moment on account of the possibility of establishing communication between our fleets and the mainland when the whole civilized world is held in suspense by the want of such communication as wireless telegraphy would make possible; indeed the benefits which might be derived from it can hardly be overestimated, when we consider how many lives might be saved and cargoes rescued from watery graves. In the course of his remarks, which were illustrated by practical experiments, Captain Kennedy said that, without detracting from the honor due Marconi for his brilliant discovery, it was only fair to point out that Captain Jackson had been engaged on wireless telegraphy before the former's arrival in England. Indeed, it was difficult to say which of these inventors was the first to discover the virtue attached to the use of the vertical wire. Marconi, however, was first at the Patent Office.

If lighthouses were equipped with a simple arrangement, electric as well as light flashes could be emitted to guide ships in thick and foggy weather; an incoming ship would be enabled to announce its approach; outward bound ships could receive the latest news. Information could be sent to port from great distances by placing intermediate ships as relay stations; passing cruisers could communicate with the shore without coming within visual range by night or day. A friendly craft entering a fortified harbor at night could make known its identity, and so escape destruction, and orders might be communicated between the various ships of a squadron, when, owing to atmospheric conditions, ordinary means failed. For instance, during a blockade, if the enemy happened to be within electric range, conversation could be carried on by cipher.

Master Mechanics' Association Scholarships.

There will be one vacancy in the Association Scholarships at the Stevens Institute of Technology, Hoboken, N. J., at the close of the present college year in June. Acceptable candidates for this scholarship at the June examination are sons of members or of deceased members of the Association. Any such who desire to attend the June examination should apply to the Secretary, Prof. Chas. F. Kroeh, and if found eligible, he will give certificate to that effect for presentation to the authorities, which will entitle the candidate to attend this examination beginning at the Institute on June 3, 1898. The school authorities will arrange for the examination of an applicant at any of the large cities of the country, but in that case the applicant must pay the institute a fee of $10 to cover the additional cost of conducting the examination at such point. The successful candidate will be required to take the course of Mechanical Engineering.

LOCOMOTIVE BUILDING.

The Schenectady Locomotive Works are building one engine for the Chicago & West Michigan.

The Pecos Valley Railroad has placed an order with the Brooks Locomotive Works for 8 engines.

F. M. Pease, Inc., Chicago, Ill., has sold a 10-wheel locomotive to the Arcadia & Betsy River Railroad.

The Southern Pacific has placed an order with the Cooke Locomotive & Machine Works for 11 engines.

The Illinois Central is now preparing specifications for the new locomotives referred to in our issue of March 25.

Specifications are being prepared, and bids will soon be asked for 10 locomotives by the Fremont, Elkhorn & Missouri Valley.

The Elgin, Joliet & Eastern has placed an order with the Baldwin Locomotive Works for one switching and two consolidation locomotives.

The St. Louis, Peoria & Northern has placed an order with the Baldwin Locomotive Works for one passenger locomotive with 18 x 24 in. cylinders, exactly like two recently built by the Baldwin Locomotive Works for this road. The new engine is to be exhibited at the Omaha Exposition and delivered to the St. Louis, Peoria & Northern at its close.

The Brooks Locomotive Works have received an order to build three passenger and two side-tank freight engines for the Hankaku railroad of Japan. The former will have 14 x 24 in. cylinders, 60-in. drivers, and weight about 68,000 lbs. and must be capable of hauling 12 cars at a speed of 25 miles an hour on a grade of 1 in 70. The freight engines will have 15 x 22 in. cylinders, 52-in. drivers, and weigh about 95,000 lbs., and be capable of hauling 20 cars weighing 23,000 lbs. each at a mean speed of 20 miles an hour. Both types will have steel fireboxes and brass tubes.

The Schenectady Locomotive Works have received an order to build 26 mogul engines of 3 ft. 6 in. gage for the Nippon Railroad of Japan. They will weigh 82,000 lbs., with 53,000 lbs. on the drivers, and have 14 x 22 in. cylinders; 56-in. driving wheels; steam pressure, 180 lbs.; firebox, 84 in. long, 54 in. wide and 49 in. deep; boiler, 46 in. diameter at front end; Ulster Special staybolt iron; tubes, 159 of charcoal iron, No. 13 B. W. G., 1¾ in. in diam. and 10 ft. 8 in. long; heating surface, tubes, 771 sq. ft., fire box, 66.5 sq. ft., total, 837.5 sq. ft.; grate surface, 18 sq. ft.; trailing truck, with 33-in. steel tired wheels, with wrought iron or cast steel spoke centers; tender capacity, 1,200 gals. of water and 4,500 lbs. of coal. The engines will be equipped with Nathan lubricators, Jerome piston and valve rod packing, American balanced slide valves, open hearth tires and Smith automatic vacuum brakes.

The Schenectady Locomotive Works have just received an order to build 12 more engines of the consolidation type for the Kiushiu railroad of Japan. They will be of 3 ft. 6 in. gage, and weigh about 94,000 lbs., with 84,000 lbs. on the drivers. The principal dimensions are: Cylinders, 16 x 24 in.; driving wheels, 48 in. diameter; wheel base, driving, 13 ft. 6 in.; total, 20 ft. 2 in.; boiler, extended wagon top type, 58 in. at largest course, 54 in. at the front end; firebox, copper, 84 in. long, 30 in. wide, 56½ in. deep; tubes, 180, of charcoal iron, No. 13 B. W. G., 2 in. diameter, 12 ft. long; heating surface, tubes, 1,123 sq. ft., fire box, 102 sq. ft., total, 1,225 sq. ft.; grate surface, 17.5 sq. ft.; engine truck wheels, 28 in. diameter, spoked, with 3-in. tires; the tender will have 30-in. spoke wheels. The locomotives will be equipped with Ulster Special staybolt iron, Nathan lubricators, piston rods and crank pins of Cambria steel, "Coffin" process, Jerome valve and piston rod packings, American balanced slide valves, American steel tires, two Coale pop safety valves, and steam brakes.

CAR BUILDING.

The Mt. Vernon Car Mfg. Co. is building 20 cars for the St. Louis, Peoria & Northern.

The Barney & Smith Car Co. is building 30 freight cars for the Colorado & Northwestern.

The Illinois Central order for cars will be 1,000 instead of 500, as given in our issue of April 15.

The St. Joseph & Grand Island is having three passenger cars built by Pullman's Palace Car Co.

The Pecos Valley has placed an order with Pullman's Palace Car Co. for 30 box and 20 flat cars.

The Excelsior Horse Car Line is having two cars built at the works of the Illinois Car & Equipment Co.

In addition to the 75 cars mentioned in our issue of April 29, the Interoceanic Railroad of Mexico has ordered 24 cars from the Missouri Car & Foundry Co.

It is reported that the Wisconsin Central will soon be in the market for several hundred cars, but we were unable to confirm this at the time of going to press.

It is reported that the Stockton & Tuolumne Railroad, of California, will be in the market within 60 days for some new freight cars, between 100 and 200 being the probable size of the order. (See Railroad Construction column, Feb. 4, p. 88, and April 1, p. 246.)

The Long Island Railroad has placed an order with Pullman's Palace Car Co. for 25 passenger cars for immediate delivery. They will be for use in the elevated service of the Long Island railroad into New York, via the Brooklyn Bridge, and will be built on the same general style as the regular cars of the Brooklyn Elevated, with side doors. A large number of additional cars of the same class (probably 75) will be ordered in the near future for the same service.

The Allison Mfg. Co. has been awarded a contract to build 20 box, six gondola and eight flat cars for the Seoul & Chemulpo Railroad, of Korea. The box cars will be 33 ft. 7 in. long over all and 8 ft. 10½ in. wide over all, with the exception of four, which will have brake vans. These will be 39 ft. 7 in. long and 9 ft. wide. The gondola and flat cars will be 33 ft. 7 in. long, and the former 8 ft. 8 in. and the latter 8 ft. 6 in. wide. All the cars will be of 40,000 lbs. capacity, and have 33-in. chilled iron wheels, English buffers and couplers, hand brakes, oval brakebeams and diamond trucks.

The Kiushiu railroad, of Japan, has recently sent out requisitions for prices on a large amount of equipment. Very few details are given, and some car builders have hesitated to furnish necessary blueprints and specifications. Prices on the following cars have been asked: Five hundred hopper bottom coal, 200 box and 200 flat cars, all to be of 3 ft. 6 in. gage, eight tons capacity, and to have double-spoke wheels with steel tires; 20 first class, 30 second class and 80 third class passenger cars, eight first and second class combination, 34 third class combination and eight mail and baggage cars. These will also be narrow gage.

In our issue of May 6 we stated that the Central of Georgia is building 200 combination fruit and box cars at its Savannah shops. These will be finished by June 30, and will be of 70,000 lbs. capacity, 36 ft. long, 8 ft. wide and 7 ft. high inside, and weigh 33,000 lbs. Steel (collarless) axles, trussed I-beam bolsters, Congden brake shoes, New York air brakes, Central of Georgia standard lip brasses, Gallager couplers, Dayton door fastenings, Moore doors, M. C. B. yoke draft rigging, Central of Georgia standard journal

boxes, with Fletcher lids, double board roofs, Fox pressed steel trucks and 33-in. cast iron wheels will be used.

The Harlan & Hollingsworth Co. has received an order to build three first and second class and six third class passenger, two third class baggage and two combination baggage and mail cars for the Seoul & Chemulpo Railroad, of Korea. The first and second class coaches will have transverse seats, and be capable of seating 20 and 38 passengers, respectively; the third class coaches will have four rows of longitudinal seats, one row on each side and two in the center of the car (the latter back to back), and capable of accommodating 100 passengers. All the cars will have 33-in. steel-tired wheels, English buffers and couplers, Eames vacuum brakes and Venetian blinds. The gage is 4 ft. 8½ in.

The Brooklyn Heights railroad has placed an order with the John Stephenson Co. for building 70 closed cars for fall delivery. The makes and types of trucks and motors have not yet been selected.

BRIDGE BUILDING.

CEDAR RAPIDS, IA.—The Burlington, Cedar Rapids & Northern will replace 52 bridges this year with permanent iron work. H. F. White, Chief Engineer.

CHICAGO, ILL.—An order was passed by the Drainage Board May 12 directing the Engineer to advertise for bids on all bridges yet to be erected over the channel, with the exception of the Western Indiana crossing. The bridges not yet under contract or under advertisement are: Road bridges at Lemont, Summit, Willow Springs, Lockport and the Santa Fe bridge at Lemont. The request of the city authorities of Joliet that the board erect a steel bridge at Jefferson street, the full width of the street, and unite with the city of Joliet in building a new bridge at Cass street was laid on the table. Isham Randolph, Chief Engineer.

EMMITSBURG, MD.—The Emmitsburg Railroad, it is stated, will build a steel truss bridge 136 ft. long. Jesse Nussear, Supervisor Bridges and Buildings.

FITCHBURG, MASS.—It is stated that the City Council voted in favor of building a bridge across the river on Oak Hill road. Estimated cost, $5,000.

FRANKLIN, KY.—Bids are asked until June 7 by the Fiscal Court of Simpson County for building a steel bridge, with 12-ft. roadway. G. W. Whitesides, County Judge.

KANSAS CITY, MO.—The city engineer, Mr. Henry A. Wise, has estimated the cost of a bridge at Prospect avenue, over Brush Creek, at $10,000.

MAGNOLIA, MISS.—The Commissioners of Pike County will receive bids until June 6 for building a new bridge. C. W. Vaught, Clk., Magnolia.

MILWAUKEE, WIS.—It is reported that bids will probably be asked in June for building a bridge at Broadway; estimated cost, $65,000. G. H. Benzenberg, City Engineer, can probably give information. (Feb. 4, p. 86.)

PROVIDENCE, R. I.—It is stated that the Red and Weybossat bridges will be rebuilt. Otis F. Clapp, City Engineer.

PUEBLO, CAL.—Press reports state that bids are asked until June 6 for building an iron and steel bridge across Fountain River at East First St. E. W. Hathaway, City Engineer.

ST. PAUL, MINN.—Preliminary plans have been made for a bridge to carry Summit avenue over the tracks of the Chicago, Milwaukee & St. Paul. If this bridge is built, it will be by the railroad company, under specifications made by that company and approved by the City Engineer. The plans now prepared show a bridge of about 70 ft. span on a skew of about 20 degrees. This carries a 100-ft. street over four railroad tracks. The width of the bridge from center to center of the outside girders will be just 100 ft., and the outside girders will be 71 ft. 6 in. long and the intermediate girders 66 ft. The bridge as proposed will be made up of five longitudinal plate-girders, 5 ft. 4 in. deep, carrying transverse plate-girders riveted to the webs, which in turn carry 12-in. I-beams, which support buckle plates, on which is an asphalt pavement. The I-beams carrying the buckle plates will be spaced 4 ft., center to center. The buckle plates will be ⅜ in. thick.

SYRACUSE, N. Y.—Sealed proposals will be received at the office of the City Engineer until May 23, at 3 o'clock, for furnishing materials and building a steel girder bridge over the Onondaga Creek. R. R. Stuart, City Engineer; M. Z. Haven, City Clerk.

VANCOUVER, WASH.—A bill has been introduced in Congress to authorize the British Columbia, Seattle & Pacific Coast R. R. to build a bridge over the Columbia River at Vancouver. This company was recently organized. Among those interested are Henry J. Broker, Judge Austin B. Fletcher and J. A. Simmons, all of New York. (See Railroad Construction column, March 25, p. 224.)

WARREN, O.—A new county bridge will probably be built over the Mahoning River, at Leavittsburg, Trumbull County.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Catawissa (Reading).—Preferred 2½ per cent., payable May 19.

Cleveland & Pittsburgh.—Guaranteed, quarterly, 1¾ per cent., payable June 1.

Delaware & Bound Brook.—Guaranteed, quarterly, 2 per cent., payable May 20.

Mexico Northern.—Quarterly, 1 per cent., payable June 2.

North Pennsylvania.—Quarterly, 2 per cent., payable May 25.

Third Ave. (New York).—Quarterly, 2 per cent., payable May 31.

American Ticket Brokers' Association.

This Association held its annual convention at Louisville, Ky., May 12. The officers elected for the ensuing year are Joseph M. Keener, Cleveland, President, and W. B. Carter, Louisville, Secretary.

New York Electrical Society.

The 187th meeting of the New York Electrical Society was held at Madison Square Garden on Thursday evening of last week. The feature of the evening was an address by Dr. S. S. Wheeler, on "Electrically Driven Machinery." The lecture proved of great interest to those attending, and was fully illustrated by stereopticon slides and by a number of pieces of apparatus shown in operation.

Western Railway Club.

At the meeting of the club held in Chicago, May 17, a paper by J. C. McMynn on "Specifications" was presented and discussed. A discussion was also had on "Car Side Bearings."

The election of officers resulted as follows: C. A. Schroyer, President; F. W. Brazier, First Vice-President; W. F. M. Goss, Second Vice-President; John W. Cloud, Treasurer; F. W. Sargent, William Forsyth and A. M. Waitt, Library Trustees; Peter H. Peck and H. G. Hetzler, members Executive Committee.

Engineers' Club of Philadelphia.

At the regular meeting of the club held May 7, President L. Y. Schermerhorn in the chair, a special committee presented a memorial of the late Rudolph Boerricke. Mr. Ambrose E. Lehman read a paper on "A Case of Jurisprudence in Land-Surveying," upon which a discussion followed. Mr. John Birkinbine exhibited and described a series of lantern views, showing different systems of mine timbering.

The next regular meeting will be held Saturday evening, May 21. A paper will be read by Mr. Joseph Appleton on "Recent Developments in the Application of Storage Batteries."

North-West Railway Club.

At the regular meeting of the North-West Railway Club, held at the West Hotel on Tuesday, May 10, the following officers were elected for the ensuing year: President, Tracy Lyon, M. M., Chicago Great Western Ry., St. Paul; First Vice-President, George Dickson, Gen. Foreman, Great Northern Ry, St. Paul; Second Vice-President, H. Goehrs, M. C. B., C., M. & St. P. Ry., Minneapolis; Treasurer, Alfred Child, Gen. Car Foreman, N. P. Ry., St. Paul; Secretary, T. A. Foque, Ass't Mechl. Supt., "Soo" Line, Minneapolis; Ass't Secretary, F. B. Farmer, Westinghouse Air Brake Company, Endicott Arcade, St. Paul.

A discussion was held on the following subjects: "What Is the Best Method of Tapping Out Boiler Sheets for Stay Bolts, and the Best Method for Putting in the Stay Bolts?" and "What Should Be the Proportion Between the Heating Surface and Grate Area in the Locomotive Boiler, to Obtain a Free Steaming Engine, Using the Average Western Bituminous Coal?"

This was the last meeting of the season. The next meeting will be held at the Ryan Hotel, St. Paul, on Tuesday evening, Sept. 13, 1898.

Civil Engineers' Club of Cleveland.

The regular meeting was held on May 10, at the office of the Osborn Company. A proposed amendment to the constitution was offered, as follows: The name of this Association shall be The Cleveland Society of Engineers. An amendment to this was offered, that the name of this association shall be: The Cleveland Society of Civil Engineers. Before the vote was taken, it was moved to postpone further discussion to the next meeting.

Mr. Bernard L. Green then read a paper entitled, "The Portland Cement Industry of the World." He gave a brief history of the industry and described its present condition in the various countries of Europe and in America, showing a remarkable increase in the production of cement in this country during the last few years. He described briefly the several methods of manufacture, which depend somewhat on the character of the raw material available, and gave the statistics of production in the various countries where Portland cement is manufactured. According to the latest information, the United States ranks fourth among the countries producing Portland cement, the annual output being 2,304,000 bbls., or 6.6 per cent. of the total output of the world. Germany ranks first with 38.4 per cent.; England second, with 23.7 per cent., and France third, with 8.6 per cent.

The discussion was participated in by Mr. John C. Robinson of Sandusky, Mr. Charles B. Stowe, and D. S. Clements of Cleveland, visitors, and by Messrs. Boalt, Baker and other members of the club. After adjournment the laboratory of the Osborn Company was visited, the apparatus and specimens of cement examined, and the breaking tests of some samples witnessed.

Brotherhood of Locomotive Engineers.

The biennial convention of the Brotherhood of Locomotive Engineers was begun in St. Louis, Mo., on Thursday, May 12.

An address of welcome was delivered by Dr. William Taussig, President of the St. Louis Bridge Co., and formerly for many years President of the Terminal Railroad Association. Dr. Taussig said in part: The privilege of welcoming you to St. Louis on behalf of its citizens and of its railroad fraternity gives me great pleasure. I have been a close observer of the working of your brotherhood since its small beginnings thirty-five years ago. I have had many business conferences with that branch of it which was connected with my management, and have had much personal contact with its individual members. I wish to bear witness to the solid character, the high professional standard, and the readiness to submit matters of difference to calm discussion, which have always distinguished them. . . . I do not believe that any word in the English language denoting the noblest Christian virtue, the fullest measure of good will and humanity, has ever been perverted to such base uses as when the word "sympathy" has been applied to the so-called sympathetic strike. In extreme cases, involving clearly some great principle of deep importance, a strike in aid of an organization or of fellow workers may be justified, even though the individual employees have no direct grievance. But these cases must be rare, like the cases that justify war between nations, and should be only undertaken, not boastfully and in a spirit of defiance, but soberly, prayerfully, sadly, as involving a dire necessity rather than the chance of gain or glory, and with a recognition that they involve a breach of another principle such as loyalty to just employers, duty toward society, the Government and the nation. . . . In England, so-called conciliation and arbitration boards, on which both parties in dispute are represented, and which consist of men in whose judicial qualities both parties have confidence, have prevented threatened and terminated existing strikes with great success. The North of England Board of Conciliation and Arbitration, for example, which was founded for the manufactured iron industries, in 1869, and has been in active existence ever since, has been most successful, and the London Chamber of Commerce is frequently active and useful in the same direction. It is said that some 3,000 disputes have been settled by these Boards during their existence.

In the three great railroad strikes in the United States within the last twenty years, those of 1877, 1886 and 1894, when nearly all the other organizations had lost their heads, yours never wavered; it stood firm to its post of duty. Its sober judgment, its inquiry after truth, its sense of justice, its great moral conscience, and the wisdom of its chief, kept it on the straight path. Unlike many other organizations, you have never been a menace to society. You have, instead, been messengers of good will and justice. You have resisted all blandishments from outside, tending to entangle you with associations whose aims are foreign to yours. So long as you persevere in this wise course, your association will live and prosper. No danger is greater to settled and firmly organized associations than that of over-expansion, and the chaining of their fate to that of others of different standard and of lower aims.

Your benevolent feature might be enlarged. Men may be incapacitated by age, by sickness, or by chronic ailments from serving in their profession, and for these your insurance does not provide. One of the saddest features of modern industrial life is the growing difficulty of the old, the sickly and the feeble in obtaining a living. The policy of all labor organizations is to maintain the highest rate of wages an industry can bear, and consequently the employer is necessarily driven to employ only the highest classed and the most efficient labor. In the absence of pensions among the railroad companies, it seems to me that your Brotherhood, in addition to its admirable insurance and mortuary fund, could add to it, as a new feature, an endowment fund for old age and for disabilities incurred through no fault of a member.

Dr. Taussig paid a hearty tribute to Mr. Arthur, saying: "I have had frequent occasion to confer with him when grave differences between the men and the management, affecting rules of service, had to be finally settled. His judicial temper, his high sense of rectitude, and his deep concern for the interests of the brotherhood, always tended to smooth the passions and to arouse the best instincts of its members."

PERSONAL.

—News has been received by cable from Liverpool of the drowning of Mr. T. F. B. Evans, Agent for the past ten years for the Canadian Pacific at Liverpool.

—Mr. William Whitewright died at his home, in New York City, May 13. He was at one time President of the Union Trust Co., and was for many years Chairman of the Finance Committee of that company, holding that position at the time of his death.

—Mr. John M. Ayer, of Chicago, died of pneumonia at his home in that city May 12. Mr. Ayer succeeded his father in 1872 in the management of large steel and iron interests, and controlled and managed the rolling mills at Bridgeport until his retirement from active business. He was also active in the development of the industries of Hammond, Ind., where he owned extensive property.

—Mr. J. Y. Mori, who has of late years been Vice-President, General Manager and Chief Engineer of of Nippon Railway, the largest railroad system of Japan, has been elected President of the company. Mr. Mori is a very hard worker, and his attainment of this position is due to his energy and executive ability, for political infleuce has nothing to do with private railroad systems of Japan.

—Mr. Frederick R. Scott, President of the Richmond & Petersburg, which is a part of the Atlantic Coast Line, died at his home, in Richmond, Va., Sunday, May 15, after a short illness. Mr. Scott was born in Ireland in 1830, and entered railroad service in 1873 as President of the Richmond & Petersburg, which position he occupied until his death, it being the only office he ever held with any railroad.

—Mr. Benjamin Reece, M., Am. Soc. C. E., has resigned his position as engineer of the Q & C Company, to accept a similar position with the Continuous Rail Joint Company of America. Mr. Reece has been one of the most influential and successful of the pioneers in introducing the tie plate. His position with the Q & C Company gave him an opportunity, and before that opportunity he had been prepared by years of experience in track laying and maintenance of way. We suppose that he will be stationed in Chicago.

—Mr. F. B. Lovell, instructor in the College of Civil Engineering at Cornell University, has been appointed Adjunct Professor of Civil Engineering, Columbia University. Mr. Lovell was of the class of 1891 at Cornell University, and, after having considerable field work as Assistant Engineer on location, construction and maintenance for the Michigan Central, and three years' experience as instructor in civil engineering at Lafayette College, he returned to Cornell in 1896. As Adjunct Professor of Civil Engineering at Columbia he will have charge of the Department of Railroad Engineering and of the Summer School of Surveying.

—Mr. Timothy Case, at one time Vice-president and General Superintendent of the Green Bay, Winona & St. Paul, now the Green Bay & Western, died suddenly in Chicago, Ill., May 9, at the age of 75. Mr. Case was born in Vermont in 1823, and entered railroad service in 1849 with the Hudson River Railroad. For three years, from 1851, he was Section Foreman, and from 1854 to 1865 Trackmaster of the Hudson River, and was General Superintendent of the Sussex (D., L. & W.) from that date until 1877, when he went West to become General Manager of the Green Bay & Minnesota. He was Receiver for the Green Bay & Minnesota from January, 1878, and remained as such until 1882. When that road was sold under foreclosure in June, 1881, and reorganized as the Green Bay, Winona & St. Paul, he became General Superintendent and Vice-President. The road was again reorganized in 1896 as the Green Bay & Western.

—Mr. William Henry Canniff, General Manager of the Lake Shore & Michigan Southern, has been selected as President of the New York, Chicago & St.

Louis, suceeding Mr. Samuel R. Callaway, who has been made President of the New York Central & Hudson River. The late Mr. Caldwell rose from the Presidency of the "Nickel Plate" to that of the Lake Shore & Michigan Southern, as did also Mr. Callaway. Mr. Canniff was born in Litchfield, Mich., in 1847, and has been in railroad service since 1863, having started as night watchman with the Michigan Southern & Northern Indiana (L. S. & M. S.). He was appointed to the joint agency of the Michigan Southern & Northern Indiana and the Louisville, New Albany & Chicago (C., I. & L.), with office at Salem Crossing, Mich., in August, 1868. He held that office until August, 1872, then being apointed Division Trackmaster on the Lake Shore & Michigan Southern. He held several division offices on this road until Nov. 1, 1889, when he was appointed Assistant Superintendent. He was General Superintendent from January, 1892, until March, 1896, when he was appointed General Manager.

—Locomotive Engineer James Tucker, who died at his home in Chicago on April 28 of Bright's disease, has left a remarkable record, with which only a few can be compared. In 1852 Mr. Tucker entered the service of the Chicago, Rock Island & Pacific, at Peru, Illinois, as wood passer, in which capacity he worked but a short time when he was put on a yard engine as fireman, and May 10, 1853, he was promoted to Yard Engineer. Since then, and up to February, 1898, he had been running a locomotive on the Rock Island road, his mileage being approximated at about 2,000,000 miles. During the 45 years of active service as engineer his engine never met with an accident, and the only injuries sustained personally by himself were a broken wrist and a few slight injuries, caused by losing his footing and falling off his engine into an ashpit. Barring this accident, during the entire 45 years he never lost a day on account of sickness. With the exception of being suspended for five days in 1892 for violating the rules in accepting a release order from the train porter, his record is a perfectly clear one. In view of the apocryphal stories of this kind which frequently find circulation, it is proper to say that the facts in this case come to us from an officer of the road. Besides the tribute to Mr. Tucker's fidelity and to his capabilities as an engineman, implied by the facts stated, the freedom from accidents of the class which a runner is not responsible for is worthy of note. The "accident editor" is glad to present such facts as a slight antidote to the depressing influence of the monthly records showing scores of engines derailed or smashed up, and many enginemen and other trainmen killed. The publication of Mr. Tucker's record recalls that of Porter King, who was an engineman on the Western Railroad (Boston & Albany) for 44 years, and whose engine never killed a man.

—Capt. Watson W. Rich, formerly chief engineer of the Minneapolis, St. Paul & Sault Ste. Marie (Canadian Pacific), has been appointed Consulting Engineer to the Chinese Railroad Administration, with headquarters at Shanghai. Captain Rich will be in charge of all railroad building in China under the immediate direction of Sheng Tajen, Director-General of Railroads. Several months ago when Captain Rich left America for China several of our contemporaries reported that he had been appointed Director-General of the Chinese Railroads. The Railroad Gazette paid no attention to this report, knowing it was not probable that he could receive such an appointment, as there was already a Chinese official occupying that office.

Captain Rich was born in Dayton, N. Y., March 19, 1841. He was on surveys of various railroads before becoming Assistant Civil Engineer in the Engineer Corps, U. S. A., in 1866. In July, 1870, after leaving the Government's service, he was appointed Locating, Division and Chief Engineer of the Wisconsin Central, and held that office until February, 1878. From 1874 to 1876 he was also in charge of the operation of the Northern Division of the Wisconsin Central. After leaving the Wisconsin Central, in 1878, he was engaged in examining railroad properties and projects for Boston and Chicago capitalists. He was appointed Chief Engineer of the Minneapolis & St. Louis in July, 1879, holding office until October 25, 1883. On that date he became Chief Engineer of the Minneapolis, Sault Ste. Marie & Atlantic (now M., St. P. & S. S. M.), and was Superintendent of the same road from November 11, 1884, until resigning, January 1, 1887. But he remained as Chief Engineer until August 1, 1890, on which date he was appointed Consulting Engineer. He was made Chief Engineer of the Minneapolis, St. Paul & Sault Ste. Marie in 1892. He left America January 6, this year, on a three months' leave of absence.

ELECTIONS AND APPOINTMENTS.

Astoria & Columbia River.—J. C. Mayo, formerly General Freight and Passenger Agent of the Corvallis & Eastern at Corvallis, Ore., has been appointed to the office of General Freight and Passenger Agent of the A. & C. R. with headquarters at Astoria, Ore.

Centralia & Chester.—A. N. East has been appointed Assistant General Freight and Passenger Agent, and the office of Traveling Freight and Passenger Agent, heretofore occupied by him, has been abolished. His headquarters remain at Sparta, Ill.

Central Ohio (B. & O.).—At the annual meeting of this company, which is the Chicago Division of the Baltimore & Ohio, held at Columbus, O., Apr. 27, the following Directors were elected: George E. Bradfield, Barnesville, O.; J. H. Collins, Columbus, O.; A. B. Crane, J. W. Garrett, George C. Jenkins and James Sloan, Jr., all of Baltimore, Md.; John R. Hall, Quaker City, O.; John Hoge and David Lee, Zanesville, O.; C. H. Kibler, Newark, O.; William Kinney, Belmont, O.; Daniel C. List, Wheeling, W. Va.; W. W. Peabody, Cincinnati, O. At a meeting of the Directors held later, the Board organized by electing the following officers: President, J. H. Collins; Auditor, G. W. Booth; Treasurer, W. H. Ijams, and Secretary, P. C. Sneed.

Chicago & West Michigan.—A. L. Grandy has been appointed Assistant Engineer with office at Grand Rapids, Mich., succeeding J. F. Demling, resigned.

Chicago, Burlington & Quincy.—N. E. Jennison has been appointed Assistant Purchasing Agent, with office in Chicago, succeeding George G. Yeomans, promoted. (March 25, p. 224.)

Chicago Great Western.—O. Cornelisen has been appointed Acting Superintendent of the Eastern Division, between Chicago and Oelwein, Ia., with headquarters at Dubuque, Ia. The office of Superintendent of Transportation has been abolished. J. Burlingett, who formerly held that position, has been promoted to be Superintendent of the Southwestern Division. (Apr. 29, p. 316.) The change in method of operation, which restores the Division Superintendencies, that were abolished last August, took effect May 9. (Aug. 6, 1897, p. 562.)

Chicago, Peoria & St. Louis.—The statement in our issue for last week that Ralph Blaisdell was elected, at the recent annual meeting, Secretary and Treasurer is incorrect, there having been no change. Mr. Blaisdell remains as Auditor of the C. P. & St. L. and Secretary and Treasurer of the St. Louis, Chicago & St. Paul.

Cincinnati & Dayton (C. H. & D.).—The stockholders at the annual meeting held in Middletown, O., May 5, elected the following Directors to serve during the ensuing year: M. D. Woodford, C. G. Waldo, Eugene Zimmerman, George R. Balch, Frederick H. Short, Robert Wilson and R. P. Riefenberick.

Cincinnati Northern.—T. C. M. Schindler has been appointed General Freight and Passenger Agent with office at Van Wert, O., succeeding C. W. Cook, resigned. (May 6, p. 332.) Mr. Schindler was formerly Passenger Agent of the Cincinnati, Jackson & Mackinaw, the predecessor of the C. N.

Corvallis & Eastern.—(See Astoria & Columbia River.)

Escanaba River.—The officers of this company, referred to in the Construction Column, were elected at Marinette, Wis., May 10, as follows: President, Isaac Stephenson; Vice-President, J. A. Van Cleve; Secretary and Treasurer, H. A. J. Upham; General Manager, J. W. Wells. Directors, Isaac Stephenson, Marinette; Daniel Wells and H. A. J. Upham, Milwaukee; J. W. Wells, Menominee; J. A. Van Cleve, Marinette.

Florida Central & Peninsular.—I. M. Fleming, Division Passenger Agent with headquarters in Savannah, Ga., has resigned.

Georgia & Alabama.—The headquarters of Chief Engineer C. P. Hammond, Car Accountant E. C. Lucas, and Trainmaster E. E. Anderson have been transferred from Americus to Savannah, Ga. G. W. Patrick, formerly Supervisor at Hurtsboro, Ala., has been appointed Supervisor at Richmond, Ga., succeeding M. C. Tarver. Bayley Hipkins, formerly Supervisor at Meldrim, Ga., has been transferred to Savannah.

Georgia R. R. & Banking Co.—At the annual meeting, held in Augusta, Ga., May 12, two new Directors, James Tobin and Billups Phinizy, were elected to fill vacancies caused by the death of Charles H. Phinizy and the resignation of William E. McCoy. (May 13, p. 347.)

Great Northern.—W. D. Scott, formerly Trainmaster on the Northern Division, with headquarters in Great Falls, Mont., has been appointed Assistant Superintendent of the same division, succeeding J. W. Donovan, who has been appointed Assistant Superintendent of the Montana Division.

Jalapa & Cordoba.—The officers of this company are as follows: President, J. B. Haggin, 15 Broad St., New York City; Vice-President, General J. B. Frisbie; Traffic Manager and Superintendent, T. H. Green; Treasurer and Auditor, W. B. Watts, all of Jalapa, Mex. Secretary, E. M. West, 15 Broad St., New York City.

Kansas City Belt.—Charles A. Goodnow and H. U. Mudge were elected new Directors at the annual meeting held in Kansas City, May 10, they succeeding W. J. Ferry and D. B. Robinson.

New York Central & Hudson River.—The following changes in the organization of the Freight Department have been announced in a circular issued by Traffic Manager Nathan Guilford to take effect June 1:

The offices of General Freight Traffic Manager, Foreign Freight Agent at New York City, General Freight Agent of the Rome, Watertown & Ogdensburg, and Assistant Freight Agent of the R., W. & O. are to be abolished. The Division Freight Agencies as now existing are also to be abolished, and will be superseded by the following organization of four divisions: Western Division, including all stations on main line and branches west of Newark and Canandaigua; Mohawk Division, comprising all stations from and including Newark and Canandaigua to and including Rensselaer, Albany and Troy; the Rome, Watertown and Ogdensburg R. R. and branches, and the Carthage & Adirondack R. R. to be known as the R., W. & O. Division; Adirondack Division, comprising the Mohawk & Malone R. R. and branches. Communications relating to the freight traffic of the Hudson River, Harlem or N. Y. & Putnam roads should be addressed to the General Freight Agent, or Assistant General Freight Agent, Grand Central Station, to whom all Division Freight Agents are also to report. The business heretofore conducted in the Foreign Freight Office at New York will, on June 1, be transferred to the Lighterage Department; and all communications relating thereto should thereafter be addressed to Alfred Skitt, General Manager, Lighterage Department, No. 10 Broadway, New York City.

The following appointments in the Freight Department are announced to take effect on the same day: Samuel Goodman, at present General Freight Traffic Agent, and also Freight Agent of the R., W. & O., is to be Assistant Traffic Manager. Edwin H. Croly will be Division Freight Agent of the Western Division, with office at Buffalo, N. Y. Seneca Kelly is to be Division Freight Agent of the Mohawk Division, with office at Syracuse. F. L. Wilson is to be Division Freight Agent of the R., W. & O. Division, with office at Watertown. H. D. Carter is to be Division Freight Agent of the Adirondack Division, with office at Malone.

In a circular issued by George H. Daniels, General Passenger Agent, relative to the reorganization of the Passenger Department, we notice the following appointments, taking effect June 1: G. C. Gridley to be General Agent of the Passenger Department at Watertown, N. Y.; A. E. Brainerd, heretofore Traveling Passenger Agent at Albany, to be District Passenger Agent, with office in the same city; O. E. Jenkins to be District Passenger Agent at Syracuse, N. Y.; Thomas Meadows & Co., General European Agents at Liverpool and London.

Theodore Butterfield, General Passenger Agent of the R., W. & O. at Syracuse, N. Y., has resigned, and all correspondence relating to passenger traffic is hereafter to be addressed to the General Passenger Agent of the N. Y. C. & H. R. in New York.

North Shore Despatch.—J. Y. Pellen, formerly Westbound Freight Agent of the Lackawanna line, has been appointed Westbound Freight Agent of the North Shore Despatch, with headquarters at St. Louis, Mo.

Panama Railroad.—F. S. Higbid, formerly Roadmaster of the New York Division of the Erie, has been appointed to the position of Assistant Engineer of the Panama R. R. with headquarters at Panama.

Philadelphia & Reading.—H. C. Tucker, General Western Freight Agent, with office in Chicago, has resigned. He has been succeeded by F. W. Fowkes. (May 6, p. 333.)

Pittsburgh, Cincinnati, Chicago & St. Louis.—J. C. McCullough has been appointed to the newly created office of Assistant Traveling Engineer.

Postal Telegraph-Cable Company.—C. M. Baker, who has been Superintendent of Construction of the Postal Telegraph-Cable Co. since its organization, was promoted on May 1 to be General Superintendent of Construction of the Western Division with headquarters at Chicago, Ill.

Queen & Crescent.—T. F. Steele, General Freight Agent of the Alabama Great Southern, with office at Birmingham, Ala., has resigned, and has been appointed General Freight Agent of the New Orleans & Northeastern, succeeding A. F. Barnett, resigned on account of ill health.

Richelieu & Ontario Navigation Co.—G. A. Browne, Assistant Traffic Manager, has been appointed Traffic Manager, with office in Montreal, Que., succeeding Alexander Milloy. The company operates steamers between Toronto and Montreal.

Rio Grande Western.—J. A. McGregor of Chicago, Ill., has been appointed to the new position of Traveling Freight Agent, with office at 215 Dearborn St., Chicago, Ill.

Sioux City & Northern.—At the annual meeting held in Sioux City, Ia., May 11, Samuel J. Beals, one of the Receivers for the road, was elected President. Craig L. Wright was elected Vice-President, and Howard S. Baker, Secretary and Treasurer, all of Sioux City, Ia.

Wheeling & Lake Erie.—C. C. Harter, General Storekeeper, with office at Toledo, O., has resigned. He has been succeeded by W. P. P. St. Clair.

Williamsville, Greenville & St. Louis.—R. J. Medley was recently elected Secretary, with office at Williamsville, Mo., succeeding C. W. White.

RAILROAD CONSTRUCTION

Incorporations, Surveys, Etc.

ASTORIA & COLUMBIA RIVER.—The first train ran over this new line from Astoria, Ore., along the south bank of the Columbia River to Gobble, 60.3 miles, on May 16. (April 22, p. 300.)

ATLANTIC, VALDOSTA & WESTERN.—Extensions of about 30 miles are proposed at either end of this line to complete the connection from Valdosta, Ga., to Jacksonville, Fla. It has been finished from Haylow, Ga., southeast 71.3 miles to Crawford, Fla. E. C. Long of Haylow is Vice-President and General Manager. (Dec. 10, 1897, p. 878.)

BALTIMORE & OHIO.—Five thousand tons of 85-lb. steel are to be immediately placed on the Second and Third Divisions, between Washington Junction and Grafton, W. Va. The 10,000 tons recently delivered is to be placed on the Chicago and other divisions west of the Ohio River, and the rail that will be taken up, being in good condition, will be relaid on lighter divisions.

Considerable work is being done on the Pittsburgh Division in replacing old bridges with new and stronger structures. There are nine single-span, five two-span and one three-span steel bridges now being built.

The work of filling in the wooden trestle at the Greenwood (W. Va.) yards is progressing slowly, and it will take probably five years to complete the work. The Jones & Laughlin Co., an iron company whose furnaces are near the work, has the contract. (Official).

BRIDGETON & SACO RIVER.—R. D. Shannahan of Portland, Me., has taken the contract for grading the extension from Bridgeton, Me., north 5 miles to Harrison. William F. Perry of Bridgeton is President. (March 25, p. 224.)

CANADIAN ROADS.—A bill has been introduced into the British Columbia Parliament which calls for a loan not to exceed $5,000,000 to be used for subsidies for railroads not to exceed $4,000 per mile as follows:

For a standard gage railroad from Penticton to the Boundary Creek district, approximately 100 miles in length:

For a standard gage railroad from Robson to the Boundary Creek district, to connect with the railroad mentioned in sub-section (a) hereof, approximately 80 miles:

For a standard gage railroad from the coast, in the neighborhood of English bluff, near Point Roberts via Chilliwack to Penticton, approximately 230 miles:

For a standard gage railroad from Bute Inlet to Quesnelle, approximately 230 miles:

For not more than 400 miles of narrow gage railroad from Teslin Lake to a seaport in British Columbia, divided by the Stikine River into the northern and southern sections.

CENTRALIA & CHESTER.—The contest over the right of way for the extension of this line into Chester, Ill., has been settled in favor of the railroad and it is stated that work is to be resumed at once. (Mar. 11, p. 188.)

CHESAPEAKE BEACH.—Rails are laid on 6 miles of this road from Washington, D. C., east about 30 miles to Chesapeake Beach. Over 500 men and 100 horses and mules are at work. The company expects to have the line completed by Sept. 1.

CHICAGO & SOUTHEASTERN.—Work is being pushed, according to report, on the extension from Anderson, Ind., east 18 miles to Muncie. Fifteen miles has been graded and the rails and ties are on the ground. (Mar. 25, p. 224.)

CHICAGO, INDIANAPOLIS & LOUISVILLE.—This company proposes to change its line from Clear Creek Station south to Harrodsburg Station 8 miles on the main line in Monroe County, Ind. Surveys are completed and final estimates are being made. The probability is that the line will be built this season. No contracts have been awarded. The maximum curviture is to be 5 degrees and the maximum grade 30 ft. per mile. No rails or rolling stock will be required, the company having sufficient on hand. If the work is to be carried on this season bids will be asked in about two weeks. (Official.)

CHIHUAHUA & PACIFIC.—H. J. Neeland and G. Webb of El Paso, Tex., have been awarded the contract for building the first 100 miles of this line from Chihuahua, Mex., west 200 km. (124 miles) to Guerrero. Edward S. Safford of Chihuahua, Mex., is Chief Engineer. (March 11, p. 188.)

CINCINNATI, PORTSMOUTH & VIRGINIA.—The new line from Batavia, O., east 6 miles to a connection with the main line, built to replace the old road on account of an unusually heavy grade, has been finished and trains began running the first of the month. This improvement was begun about two years ago and required two trestles, one 50 ft. high and 350 ft. long, and another 40 ft. high and 200 ft. long. (June 12, 1896, p. 483.)

COLUMBIA SOUTHERN.—Work was begun May 10 on the extension from Wasco, Ore., south to Moro, 17 miles. The first 10 miles, from Biggs to Wasco, was opened for traffic Oct. 3. It is proposed to extend the line to Prineville, about 120 miles. D. C. O'Reilly of Wasco, Ore., is General Manager. (Oct. 15, 1897; p. 736.)

CROOKSTON TERMINAL.—This company has been incorporated in Minnesota, with a capital stock of $25,000, to build a terminal system at Duluth in connection with the Northern Pacific.

DETROIT & LIMA NORTHERN.—Work is reported to have been indefinitely suspended on the Columbus & Northwestern extension from St. Johns, O., to Bellefontaine. (March 11, p. 198.)

DULUTH & NORTHERN MINNESOTA. — This company was incorporated in Minnesota May 12, with a capital stock of $200,000, to build a logging road from Duluth northeast through St. Louis and Lake counties into extensive timber tracts owned by Alger, Smith & Co. of Detroit, Mich., promoters of the railroad. The senior member of the firm is General Russell A. Alger, the present Secretary of War. The incorporators and officers are: President, Martin S. Smith, Detroit, Mich.; Vice-President, John Millen, Black River, Mich.; Secretary and Treasurer, Jas. C. McCaul, Detroit, Mich.; Auditor, George H. Stalker, Detroit. Additional incorporators: George T. Marshall, Detroit; Arthur W. Ranney, James W. Bayly and Fitzjames Hill of Black River, and Ralph N. Marble of Duluth.

ESCANABA RIVER.—This company, whose organization was reported under "New Roads" for April 1 (p. 246), has completed its organization with a capital stock of $200,000, and proposes to build about 25 miles of road this year. The line as projected is to extend from Escanaba, Mich., northwest about 60 miles to Republic, a point on the Chicago & Northwestern. Men are at work clearing the right of way. The officers are given under Elections and Appointments.

GALLATIN.—Contracts for from 40 to 50 miles of this line will probably be let in June. The line as proposed is from Three Forks, Mont., on the Northern Pacific, southwest about 100 miles to coal fields. The company hopes to have the first section in operation some time during the summer. W. W. D. Turner of Bozeman, Mont., is President. (March 11, p. 188.)

GALVESTON, BRAZOS & SOUTHWESTERN.—Work is reported to have ceased, pending the war scare, on this line, projected from Galveston, Tex., west about 150 miles to Victory. (Dec. 3, 1897; p. 860.)

KUSHEQUA.—This company has been incorporated in Pennsylvania to build a line from a point on the Mt. Jewett, Kinzua & Riterville, 1 mile east of Kushequa, in McKean County, to run east 15 miles to connect with the Clermont Branch of the Western New York & Pennsylvania at Farmersville. The Directors are: Elisha K. Kane (President), A. B. Cody, T. E. Moulton, C. D. Lamb, Lejune Keplet, N. C. Cody, all of Kushequa.

MERCHANTS & MANUFACTURERS' RAILROAD CO.—For an extended account of the plans of this company, whose organization was noted in this column May 6 (p. 332), see page 357 of this issue—A "Terminal Scheme for Detroit."

MEXICAN CENTRAL.—About 35 km. (21.7 miles) of track has been laid out of Jiminez, Mex., on the line from that city southwest about 55 miles to Parral, and grading extends to kilometer 78 (48.5 miles). One thousand men are at work and it is expected that the line will be completed by July 1. (Mar. 11, p. 188.)

MEXICAN RAILWAY.—The semi-annual report of this company states that the work of ballasting the line, which was commenced some time ago, is going on steadily. As a consequence the cost of maintenance of permanent way has already diminished, and may be expected to diminish still further as the employment of the steel sleeper and good ballast is extended. The works in Vera Cruz Harbor are also approaching completion. The harbor has been dredged to a general depth of 28 ft. Contracts have been awarded, and work has been begun on several wharves. George Foot, Buena Vista Station, Mex., is Engineer in charge of the improvements.

MICHIGAN CENTRAL.—N. P. Glenn of Toledo, O., according to report, has been awarded a contract for building 3 miles of road from Union City, O., to the marl beds of the Union City Cement Works.

NEW ROADS.—G. M. Pepper of Minneapolis, Minn., is reported to have the general contract for the 2¾ miles of road to connect the Arnold and the Copper Falls mines near Houghton, Mich. Carl Hall of Marquette, Mich., has a sub-contract. (May 6, p. 332.)

According to report, preliminary surveys are in progress for a railroad to connect the Highland Boy Mine at Goldweir, Utah, in the West Mountain mining district, with a new smelter to be built at Salt Lake City, Utah. The smelter and road are to be owned by Samuel Newhouse of Salt Lake City.

OCONEE & WESTERN.—President H. A. Clare, 45 Exchange Place, New York, after a trip of inspection over the road, writes that the property has been much improved. A project is under consideration to build an extension from the present terminus at Hawkinsville, Ga., southwest about 30 miles to Cordele, where connection will be made with the Georgia Southern & Florida, the Georgia & Alabama and the Albany & Northern. That part of the road graded as originally projected from Hawkinsville northwest 13 miles to Grovania will be abandoned. The line runs from Hawkinsville to Dublin, 40 miles.

PENNSYLVANIA.—Between 500 and 600 men are at work on the improvements between Altoona and Bennington, Pa. Masonry work has been completed and grading will probably be finished by the middle of June. The work of straightening the line near Nineveh, Pa., which was commenced about two years ago, is nearly finished. A large section of the new track is already in use. On the Philadelphia, Wilmington & Baltimore line the work on the improvements near Macon Hill, Md., is nearly completed, and rails are being laid. (Official.)

PITTSBURGH & LAKE ERIE.—Grady & Coda have the contract for building the new train shed at Pittsburgh, Pa., and work has already started. (April 1, p. 246.)

QUEEN ANNE'S.—Track is laid on the extension from Lewes, Del., to connect with the Shore Line of the Pennsylvania to Rehoboth Beach. (April 1, p. 246.)

RIO GRANDE, SIERRA MADRE & PACIFIC.—A branch line, according to report, is being built from San Pedro, Mex., to the Candelaria mines, 5 miles. This line, which runs from Ciudad Juares southwest 157 miles to Casas Grandes, was completed last year.

SOUTHERN PACIFIC.—Two thousand five hundred ft. of water frontage has been bought at Sabine Pass, Tex., where terminals and yards are to be placed. It is reported that the track between Beaumont and Sabine Pass is to be reballasted and relaid with heavy steel.

SOUTH PARK & ROYALTON.—This company was incorporated in Ohio May 9, with a capital stock of $10,000, to build a line from a point on the Cleveland Terminal & Valley, 12 miles south of Cleveland, near South Park, to run west about 15 miles to Royalton Center. The incorporators are: Virgil P. Kline, F. H. Goff, C. H. Gale, S. H. Tolles and T. H. Bushnell.

WATERVILLE & WISCASSET.—Surveys are reported completed from Weeks Mills, Me., north 13.3 miles via China, East and North Vassalboro and Winslow to Waterville, Me. Frank Redington of Waterville is President. (May 6, p. 333.)

WESTERN AMERICAN COAL CO.—This company has been incorporated in the State of Washington, with a capital stock of $500,000, to build a road from its mines, located 8 miles south of the foothills of Mt. Rainer to Carbonado, on the Northern Pacific, 7 miles, and it is reported that building is to begin at once. T. B. Corey, Seattle, Wash., is General Manager.

WESTERN MARYLAND.—J. R. Serpell & Co., of Louisville, Ky., have received the contract for grading, masonry and ballasting on the Washington and Franklin cut-off from Hagerstown, Md., to a point near Altenwald, Pa. The work is to be completed by Oct. 31. (March 4, p. 170.)

WIGGINS FERRY CO.—This company intends to build a spur track through certain street in St. Louis, Mo., to connect with the St. Louis Transfer Ry. lines.

Electric Railroad Construction.

ATLANTIC CITY, N. J.—Press reports state that J. J. Patterson of Philadelphia and A. C. Welhouse of Lancaster, Pa., are organizing a company to build an electric railroad from Camden to Atlantic City. It is proposed to incorporate with a capital of $600,000.

BUFFALO, N. Y.—The Buffalo & Lockport Ry. Co. has organized by electing the following officers: W. C. Ely, President, Niagara Falls, N. Y.; Henry J. Pierce, Vice-President, Buffalo, N. Y.; Burt Van Horn, Secretary and Treasurer, Niagara Falls, N. Y. Mr. Ely is reported to have said that the road will be in operation between Buffalo and the Hodge Opera House, Lockport, over the tracks of the Erie by July 1, and that an extension would then be commenced to Olcott and Wilson. (May 6, p. 333.)

CINCINNATI, O.—The Cincinnati & Hamilton Electric St. Ry. Co. has increased its capital from $10,000 to $600,000. This company is building from Hamilton to College Hill. (Feb. 12, 1897, p. 122; March 11, 1898, p. 179.)

COLUMBUS, O.—The Worthington, Clintonville & Columbus St. Ry. Co. has been reorganized with the following officers: George H. Worthington, President; F. D. Simons, Vice-President; T. A. Simons, Secretary and Treasurer. This company operates 5 miles of track, but will make extensions in Columbus and to the village of Delaware.

DES MOINES, IA.—The Inter-Urban Ry. Co. was recently incorporated, with a capital of $50,000, to build an electric railroad from Des Moines to Valley Junction, 3 miles. The incorporators are H. H. Polk, Simon Cassady and J. B. Jones.

MACON, GA.—The Macon & Indian Spring Electric Street Railway Co., press reports state, recently bought the Macon electric lighting plant, and will install a new engine and electrical machinery. Heretofore the railroad used power furnished by Macon Gas Light & Power Co.

PROVIDENCE, R. I.—The Union R. R. has had inspected the available routes for an extension from Riverside to Warren, Bristol and Fall River. Mr. A. T. Potter, General Manager, is reported to have said that no choice of highways was made, as the towns must first be consulted, but it is intended to secure a route as soon as practicable.

WAUKEGAN, ILL.—The Chicago & Milwaukee Electric Railway Co., recently incorporated, has bought the property and franchises of the Bluff City Electric Street Railway Co., of Waukegan, and is now completing the road from Waukegan to Highland Park, 18 miles. The company expects to extend the road this fall to Evanston, making a continuous line of about 30 miles. The officers of the company are: George A. Ball, Pres.; Albert C. Frost, Vice-Pres. and Treas.; George M. Seward, Secy.; F. O. Rusling, Mgr. The general offices will be at the power station, Fort Sheridan, and the Chicago office 108 La Salle Street. (Jan. 28, May 6, pp. 71, 333.)

WILMINGTON, DEL.—A bill is before the Delaware Legislature to allow the Wilmington & Brandywine Springs and the Wilmington & Elsemere electric railroads to consolidate, and also to compel the Street and Sewer Department of Wilmington to give the Wilmington & Brandywine Springs Co. permission to enter the city. These roads are now, we understand, nearly completed and ready to commence operation. (Aug. 13, 20, Sept. 17, Dec. 3, '97; pp. 579, 596, 659, 861.)

WINTON, PA.—The Seymour St. Ry. Co. is reported incorporated to build an electric railroad 5 miles long in Winton. Capital stock, $30,000. Incorporators: J. F. Cummings, George Dando, James Bell, of Winton; W. G. Robertson, of Dunmore, and C. P. O'Malley, of Scranton.

GENERAL RAILROAD NEWS.

Railroad Earnings.

Showing the gross and net earnings for the periods ending at the dates named:

March 31:		1898.	1897.	Inc. or Dec.	
Boston & Albany.					
3 months.........	Gross	$2,123,080	$2,028,716	I.	$94,364
3 "	Net	801,212	764,639	I.	36,573
Delaware, Lackawanna & Western.					
New York, Lackawanna & Western.					
3 months.........	Gross	$1,422,396	$1,235,526	I.	$186,870
3 "	Net	504,826	451,877	I.	52,949
Syracuse, Binghamton & New York.					
3 months.........	Gross	158,962	167,334	D.	8,372
3 "	Net	39,127	66,167	D.	27,040
Erie.					
3 months.........	Gross	$6,547,948	$6,258,599	I.	$289,349
3 "	Net	1,479,190	1,404,286	I.	74,904
Lake Erie & Western.					
1 month...........	Gross	$283,152	$270,836	I.	$12,316
1 "	Net	118,168	114,619	I.	3,549
3 months.........	Gross	830,921	792,114	I.	38,807
3 "	Net	347,500	339,250	I.	8,250
Manhattan Elevated (N. Y.).					
3 months.........	Gross	$2,429,301	$2,387,504	I.	$41,797
3 "	Net	1,067,756	1,048,514	I.	19,242
Missouri, Kansas & Texas.					
1 month	Gross	$820,510	......		......
1 "	Net	158,502	......		......
9 months.........	Gross	9,735,953	......		......
9 "	Net	3,354,055	......		......
New England.					
3 months.........	Gross	$1,252,623	$1,130,620	I.	$122,003
3 "	Net	237,916	230,602	I.	7,314
New York, Chicago & St. Louis.					
3 months.........	Gross	$1,569,358	$1,310,984	I.	$258,374
3 "	Net	255,838	213,076	I.	42,762
New York, New Haven & Hartford.					
3 months.........	Gross	$6,771,030	$6,433,176	I.	$337,854
3 "	Net	1,809,398	1,891,860	D.	82,462
Philadelphia & Erie.					
1 month	Gross	$283,872	$290,621	D.	$6,749
1 "	Net	73,043	79,288	D.	6,245
3 months.........	Net	127,029	187,342	D.	60,313

April 30:		1898.	1897.	Inc. or Dec.	
Baltimore & Ohio.					
1 month	Gross	$2,368,785	$1,982,520	I.	$386,265
1 "	Net	602,418	322,570	I.	279,848
Cincinnati, New Orleans & Texas Pacific.					
1 month...........	Gross	$320,561	$299,555	I.	$21,006
1 "	Net	80,727	104,514	D.	23,787
10 months.........	Gross	3,253,527	2,836,324	I.	417,203
10 "	Net	1,057,334	884,693	I.	172,641
Nashville, Chattanooga & St. Louis.					
1 month	Gross	$428,865	$393,229	I.	$45,636
1 "	Net	131,701	129,644	I.	2,057
10 months........	Gross	4,698,225	4,208,484	I.	489,741
10 "	Net	1,611,702	1,564,697	I.	47,105
Pittsburgh, Cincinnati, Chicago & St. Louis.					
1 month...........	Gross	$1,268,315	$1,057,654	I.	$210,661
1 "	Net	215,835	176,153	D.	39,682
4 months.........	Gross	5,106,077	4,380,495	I.	725,582
4 "	Net	1,198,426	958,070	I.	240,350

BLOOMSBURG & SULLIVAN.—The bondholders' committee, of which Morton McMichael, Philadelphia, is Chairman, announces the unanimous consent of the bondholders to a plan of readjustment without foreclosure, as follows: Of the $559,000 5 p. c. bonds outstanding each $1,000 is to receive in new 5 p. c. first mortgage 30-year coupon bonds (total issue not to exceed $400,000), free of all taxes, $666.66, and in income non-cumulative 5 p. c. bonds (total issue not to exceed $200,000), secured by second mortgage, free of taxes, $333.33. The four overdue coupons of $25 each from July 1, 1896, are to be surrendered on payment of $10 cash. This line extends from Bloomsburg, Pa., to Jamison City, 30 miles, and default on interest was made July 1, 1896.

BROOKLYN ELEVATED. — Holders of various bonds of the B. E. and the Seaside & Brooklyn Bridge Elevated are notified that the fourth and last installment of 35 p. c. is due and payable at the office of the Central Trust Co., New York, June 1. The third installment was payable May 9, the second March 7, and the first February 7. (May 6, p. 333.)

CATONSVILLE SHORT LINE (Philadelphia, New England & Baltimore).—Arrangements are in progress for the sale of this line, which is ultimately to pass into the hands of a number of residents near Catonsville, Md. It extends from Loudon Park, Md., to Catonsville, 3.8 miles. It was opened Nov. 10, 1884, and leased from that date to the Baltimore & Potomac line of the Pennsylvania. It is stated that an attempt will be made to arrange with the P. RR. to operate the road.

CENTRAL WASHINGTON.—A full report of the reorganization plan shows, in addition to the details given last week, that each holder of the C. W. trust certificates outstanding under the agreement of

March 19, 1894, is to receive $715 par value of new first mortgage Washington Central bonds, and $650 par value of voting trust certificates of the Northern Pacific common stock for each trust certificate representing a $1,000 C. W. bond. J. P. Morgan & Co., of New York, are to hold in trust $37,180 of the new W. C. first mortgage bonds to be distributed in the same proportion to owners of such of the 52 C. W. bonds still outstanding as may present them within two years, after which none of the new bonds can be claimed until the N. P. Co. requests their cancellation.

COLUMBUS, HOCKING VALLEY & TOLEDO.—The United States Circuit Court at Columbus, O., has delivered $240,000 of receiver's equipment bonds to Receiver Montserrat to be used for redeeming outstanding notes of an equal amount. May 6, p. 334.)

GALVESTON, LA PORTE & HOUSTON.—Judge Bryant, of the United States District Court, at Galveston, Tex., has removed the upset price of $500,000 and advertised the sale for June 7. Each bidder must deposit $50,000. At the attempted sale on May 3 the highest bid was $350,000. (May 6, p. 334.)

GRAND TRUNK.—The Directors have decided to give holders of Hamilton & North Western 6 p. c. first mortgage bonds maturing June 1 the option of accepting £98 of perpetual 4 p. c. consolidated debenture stock for each £100 bond in addition to the half year's interest of 3 p. c. payable June 1. In order to register even amounts, the company will allot debenture stock at £102 10s. for each £100 bond. This stock will be entitled to the first quarter's interest payable July 14.

KINGSTON & PEMBROKE.—A bill providing for the reorganization of this company has passed the Dominion Railroad Committee. The road was originally bonded for $572,000 in 30-year 6 p. c. bonds, but no interest has been paid for the last five years. Some months ago the road went into the hands of a receiver, but that official had no power to sell the line. As a means of relief, it is proposed to allow the stock, amounting to $5,000,000, to be reduced one-half, to issue preferred stock to an amount sufficient to pay off all liabilities, amounting to about $150,000, and to discharge the overdue interest charge on the bonds. It is then proposed that bondholders surrender their 6 p. c. bonds for new ones at 3 p. c. The difference of 3 p. c. for the unexpired portion of the 30 years is to be capitalized and distributed pro rata among the present holders of the bonds. (March 11, p. 190.)

LITTLE ROCK & MEMPHIS.—The foreclosure sale which was postponed from April 18 to May 18 has again been postponed to June 21. (April 22, p. 301.)

MONTANA RY.—Attorney-General C. B. Nolan of Montana has entered action against this company and the Butte, Anaconda & Pacific to declare void a contract by which the B., A. & P. will lease the Stuart Branch of the Montana from Anaconda, east 9 miles to Stuart, on the ground that the Stuart Branch is a competing line to the leasing road. The Montana Railway was leased in 1886 to the Montana Union, and all its stock is owned by the Union Pacific. The B., A. & P. runs from Butte northwest 26 miles to Anaconda.

NEW ENGLAND.—The Governor of Massachusetts has signed the bill permitting the consolidation of the New England with the New York, New Haven & Hartford, of which it has had practical control for some time. The N. Y., N. H. & H. has issued a call for a special meeting of its stockholders to ratify the lease. If the lease is ratified the N. Y., N. H. & H. will, as soon after July 1 next as it lawfully may, offer to exchange its stock for New England in the proportion of one share of N. Y., N. H. & H. for each 5 shares of N. E. common stock, and one share of N. Y., N. H. & H. for each two shares of N. E. preferred stock, including the payment of $4.50 by the N. Y., N. H. & H. on each share of its stock issued in exchange for N. E. preferred subsequent to July 1, 1898, and prior to Jan. 1, 1899. (Feb. 25, p. 150; March 25, p. 226.)

NORTHERN PACIFIC.—A drawing of $432,000 of general first mortgage bonds has been made on account of the sinking fund, and the bonds will be redeemed July 1 by the Central Trust Co., New York, at 110 and interest.

UNION PACIFIC.—The receivership of the U. P. has nominally terminated, the five receivers having tendered their resignations to the Federal Court, which have been accepted. Two receivers, Oliver W. Mink, of Boston, Mass., and Thomas P. Wilson, of St. Paul, Minn., have been appointed to continue the discharge of duties incidental to the closing of the receivership. It will be remembered that the new company took possession Jan. 31 last.

The Mercantile Trust Co., New York, is paying the $100,000 Kansas Pacific consols which were not deposited with the U. P. reorganization committee. These bonds carry coupons from May, 1894, and receive $717.32 each out of the foreclosure sale proceeds.

UNION PACIFIC, CENTRAL BRANCH.—Sealed proposals were received until May 17 at the United States Sub-Treasury, New York City, for $163,000 Central Branch U. P. first mortgage bonds held for the sinking fund of Central Pacific. (May 13, p. 350.)

WEST JERSEY & SEASHORE (Pennsylvania).—A sale of $600,000 first consolidated mortgage 4 p. c. sinking fund gold bonds due 1936, has been made to Brown Bros. & Co. These bonds are issued to pay for improvements and for double-tracking the Atlantic City Division between Camden and Atlantic City, N. J. (May 13, p. 349.)

WISCONSIN CENTRAL.—Judge Seaman, of the United States Circuit Court, at Milwaukee, Wis., on May 10 ordered the receivers to file within 20 days a schedule of rolling stock of the road under the petition of Mark T. Cox, of Morristown, N. J. (May 6, p. 334.)

Electric Railroad News.

ANNISTON, ALA.—It is stated that the Anniston Electric Co. is considering the sale of its road and plant or increasing the capital stock and reorganizing with a view to enlarging and improving the plant. This company bought the old horse road (Anniston Street Ry.) from Howard W. Sexton, trustee, in May, 1896, and changed about 2 miles to trolley. Howard W. Sexton is President and Treasurer.

BROOKLYN, N. Y.—The Brooklyn Heights R. R. Co. report for the quarter and for the 9 months ending March 31:

Three Months.	1898.	1897.	Inc. or Dec.	
Gross earnings	$1,058,169	$959,703	I.	$98,466
Operating expenses	697,710	644,948	I.	52,762
Net earnings	$360,459	$314,755	I.	$45,704
Other income	63,031	59,426	I.	3,605
Gross income	$423,490	$374,181	I.	$49,309
Fixed charges	478,947	449,342	I.	29,605
Balance deficit	$55,457	$75,161	D.	$19,704
Nine Months.				
Gross earnings	$3,380,432	$3,212,754	I.	$167,678
Operating expenses	2,075,389	1,951,254	I.	124,135
Net earnings	$1,305,043	$1,261,500	I.	$43,543
Other income	180,572	180,366	I.	206
Gross income	$1,485,615	$1,441,866	I.	$43,749
Fixed charges	1,434,198	1,436,773	D.	2,575
Balance surplus	$51,417	$5,084	I.	$46,324

The Nassau Electric Railroad Co. reports for the quarter and the 9 months ending March 31:

Three Months.	1898.	1897.	Inc. or Dec.	
Gross earnings	$419,378	$334,540	I.	$84,838
Operating expenses	297,835	222,130	I.	75,705
Net earnings	$121,543	$112,410	I.	$9,133
Other income	30,682	30,736	D.	54
Gross income	$152,225	$143,146	I.	$9,079
Fixed charges	202,369	172,772	I.	29,597
Balance deficit	$50,144	$29,626	I.	$20,518
Nine Months.				
Gross earnings	$1,483,121	$1,253,492	I.	$229,629
Operating expenses	900,729	768,578	I.	132,151
Net earnings	$582,392	$484,914	I.	$97,478
Other income	61,977	66,693	D.	4,716
Gross income	$644,369	$551,607	I.	$92,762
Fixed charges	597,043	526,445	I.	70,598
Balance surplus	$47,326	$25,162	I.	$22,164

BUFFALO, N. Y.—The earnings of the Buffalo Ry. Co. for the quarter ending March 31 are reported:

	1898.	1897.	Inc. or Dec.	
Gross earnings	$327,220	$323,076	I.	$4,144
Operating expenses	167,478	172,463	D.	4,985
Net earnings	$159,742	$150,613	I.	$9,129
Other income	6,514	5,959	I.	555
Gross increase	$166,256	$156,572	I.	$9,684
Fixed charges	104,178	106,474	D.	2,296
Balance surplus	$62,078	$50,098	I.	$11,980

HOUSTON, TEX.—In his annual report Albert N. Parlin, President of the Houston St. Ry. Co., gives the earnings for the year ending Dec. 31, 1897:

Gross earnings	$189,857
Operating expenses, 66 per cent	125,809
Net earnings	$64,048
Other income	2,039
Gross income	$66,087
Fixed charges	54,442
Balance surplus	$11,645

The car mileage for the year was 1,228,972; earnings, per car mile, .154; operating expenses per car mile, .102. The charges to construction and equipment in 1897 were $39,733, of which $32,838 was for paving and reconstruction and $6,896 for equipment. Considerable 20 and 30-lb. rails were replaced by 67 and 72-lb. steel. The management recommend the retirement of the 7 p. c. bonds by sale of the 5s held by the International Trust Co., Boston, for that purpose.

JOLIET, ILL.—The Joliet Railroad Co. has made a mortgage with the Portland Trust Co., as trustee, to secure $500,000 5 p. c. 30-year bonds. Of this loan, $325,000 has been issued, and $75,000 will be held to take up at maturity the $75,000 first 6's, due in 1904. (April 8, April 20, pp. 266, 318.)

NEW YORK, N. Y.—The earnings of the Third Avenue Railroad for the quarter and the 9 months ending March 31 are reported:

Three Months.	1898.	1897.	Inc. or Dec.	
Gross earnings	$584,616	$567,117	I.	$27,499
Operating expenses	385,078	381,262	I.	3,816
Net earnings	$199,538	$185,855	I.	$13,683
Income, other sources	14,846	13,478	I.	1,368
Gross income	$214,384	$199,333	I.	$15,051
Fixed charges, etc	92,941	91,821	I.	1,120
Balance surplus	$121,443	$107,512	I.	$13,931
Nine Months.				
Gross earnings	$1,925,756	$1,701,097	I.	$24,659
Operating expenses	1,166,921	1,142,262	I.	24,659
Net earnings	$758,835	$781,550	D.	$22,615
Income, other sources	48,252	43,698	I.	4,554
Gross income	$807,087	$825,248	D.	$18,161
Fixed charges, etc	273,905	270,423	I.	3,482
Balance	$533,182	$554,825	I.	$21,643

RACINE, WIS.—The Milwaukee, Racine & Kenosha Electric Railway Co. has made a new first-lien mortgage for $375,000, covering all its property, the old issue of $300,000 6 p. c. gold bonds having been retired and canceled. Three hundred thousand dollars of the new issue is outstanding, and $75,000 may be issued for improvements and extensions.

TRAFFIC.

Traffic Notes.

The Cincinnati, Hamilton & Dayton and the Pennsylvania lines announce that on May 30 they will begin running a through sleeping car line between Toledo and Louisville by way of Indianapolis.

The Western lines have agreed to accept the baggage of first class passengers from Pacific to Atlantic ports "in bond" between Pacific Coast ports and Chicago, and it is expected that the Joint Traffic Association lines will join in the arrangement.

It is reported that a steamship line is to be established between San Diego, Cal., and Japanese ports, in connection with the Atchison, Topeka & Santa Fe Railroad. Officers of the road say that negotiations are not yet completed, but the establishment of the line seems probable.

The first freight-storage notice that we have seen which, while complying with the Commissioner's order, leaves the conditions precisely as they were before, is that of the Chicago & Northwestern, which says that "no storage will be charged on property remaining in the freighthouses of this company as long as space can be spared for same without interference with usual business."

The Journal of Commerce, New York, has the following: "Seven million bushels of Leiter's wheat have been consigned for shipment, all via this port between now and June 20, for which ocean freights have been secured; while 2,000,000 bushels of rye will also be shipped between now and June 10, all via New York as well. The shipments of corn, now so heavy, will begin to moderate somewhat after May 25, and they are largely from ports other than New York. There appears to be more cash wheat than the trade had supposed available in this country for prompt shipment, though arrivals are large all over since the late enormous advance, 350,000 bushels red winter wheat having been bought yesterday and to-day in Pennsylvania, Iowa and Toledo to come here for delivery on May contracts."

The Secretary of Agriculture has issued, through the Bureau of Animal Industry, an order modifying the order of Feb. 18, 1895, prescribing regulations for the care of cattle and sheep shipped by sea. At the request of a large number of shippers the time which must be allowed for the animals to rest before being put aboard the vessel has been reduced from 24 hours to 12 hours. The order, Section 18, now reads: "No vessel shall be permitted to take on board any cattle or sheep, unless the same have been allowed at least twelve hours' actual rest in the yards at the port of embarkation before the vessel sails, nor until the loading of the other cargo has been completed."

Army Transportation Rates.

The Managers of the Joint Traffic Association have recommended the following rates on military traffic, the same to apply only when the transportation is performed solely for the account of the United States:

(1.) One and one-half cents per mile per capita, including the carriage in the cars with the troops of their personal effects and equipments.

(2.) Twenty cents per car per mile for animals, supplies and equipage when transported by order of the Government in the same trains which carry troops in car loads.

(3.) No mileage to be computed at less than twenty-five miles.

(4.) The mileage to be computed upon the shortest practicable route, the same to apply via all routes via which short line fares regularly apply. When transportation is specifically demanded by proper officers of the Government via longer routes than those via which short line fares regularly apply, payment to be made according to the lengths of the routes designated.

(5.) If sleeping cars are called for in the requisitions for transportation, such extra service shall be charged for in addition to the foregoing fares upon such terms as may be agreed upon with the sleeping car companies.

(6) The duly authorized published freight tariff rates on powder and explosives, either in car loads or less.

(7.) The duly authorized published freight tariff rates, less 25 per cent., on equipments and supplies, other than powder and explosives, when transported in car loads at the minimum weights established by the official classification.

(8.) The duly authorized published freight tariff rates, less 15 per cent., on equipments and supplies (other than powder, etc.).

Chicago Traffic Matters.

Chicago, May 18, 1898.

The Santa Fe has announced and put into effect a 10-cent rate on live stock from Kansas City to Chicago. This is the lowest rate of the kind ever quoted between the two points. The regular rate is 23½ cents. The cut has been met by the Rock Island, but none of the other roads are in a position to meet it. The two lines named get paying rates west of the river and can quote through rates from Indian Territory and Texas to Chicago.

Fresh trouble has broken out over the extra fares charged on the fast trains between Chicago and Denver. The Burlington does not think it fair that the Rock Island and the Union Pacific should run fast trains from Kansas City to Denver, and the Wabash and the Missouri Pacific from St. Louis to Denver without also making an extra charge. Unless the matter is at once adjusted, the Burlington threatens to ignore the excess fare out of Chicago.

Western roads have voted to make practically no concessions to the Government in freight rates on munitions of war and camp equipage. This action has aroused a storm of criticism from the Chicago and Western newspapers. The freight men are accused of a reprehensible lack of patriotism, in the face of the fact that it is notorious that for nearly a year private shippers have been accorded all manner of cut rates, not a single rate on any commodity having been maintained.

Eastbound shipments, exclusive of live stock, from Chicago and Chicago Junctions to points at and beyond the western terminus of the Trunk lines for the week ending May 12, amounted to 129,653 tons, as compared with 131,746 tons the preceding week. This statement includes 61,254 tons of grain, 9,561 tons of flour, and 22,615 tons of provisions. The following table shows the quantities and proportions carried by the respective roads:

	Week Ending May 12.		Week Ending May 5.	
Roads.	Tons.	P. C.	Tons.	P. C.
Baltimore & Ohio	14,041	10.8	14,757	11.2
C., C., C. & St. L.	5,168	4.0	13,492	10.2
Erie	17,957	13.9	18,331	13.9
Grand Trunk	4,607	3.6	4,890	3.7
L. S. & M. S.	17,300	13.3	17,358	13.2
Michigan Central	15,311	11.8	15,754	12.0
N. Y., C. & St. L.	17,576	13.6	9,718	7.4
Pitts., Cin., Chi. & St. L.	8,059	6.2	8,954	6.8
Pitts., Ft. Wayne & Chi.	18,826	14.5	18,455	14.0
Wabash	10,808	8.3	10,455	7.6
Totals	129,653	100.0	131,746	100.0

Lake shipments last week were 137,696 tons.